TECHNOLOGY DEPT.

Gas Journal

Vol. 265. 103rd Year. LONDON, MARCH 28. 1951. No. 4582. Price 1/-

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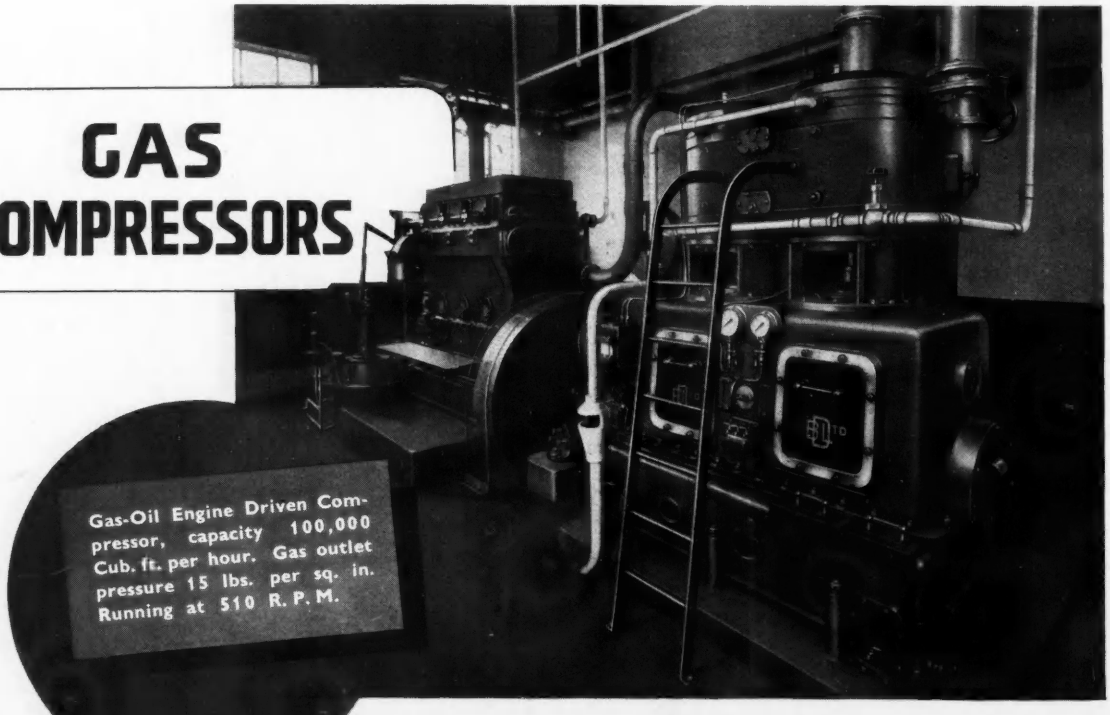

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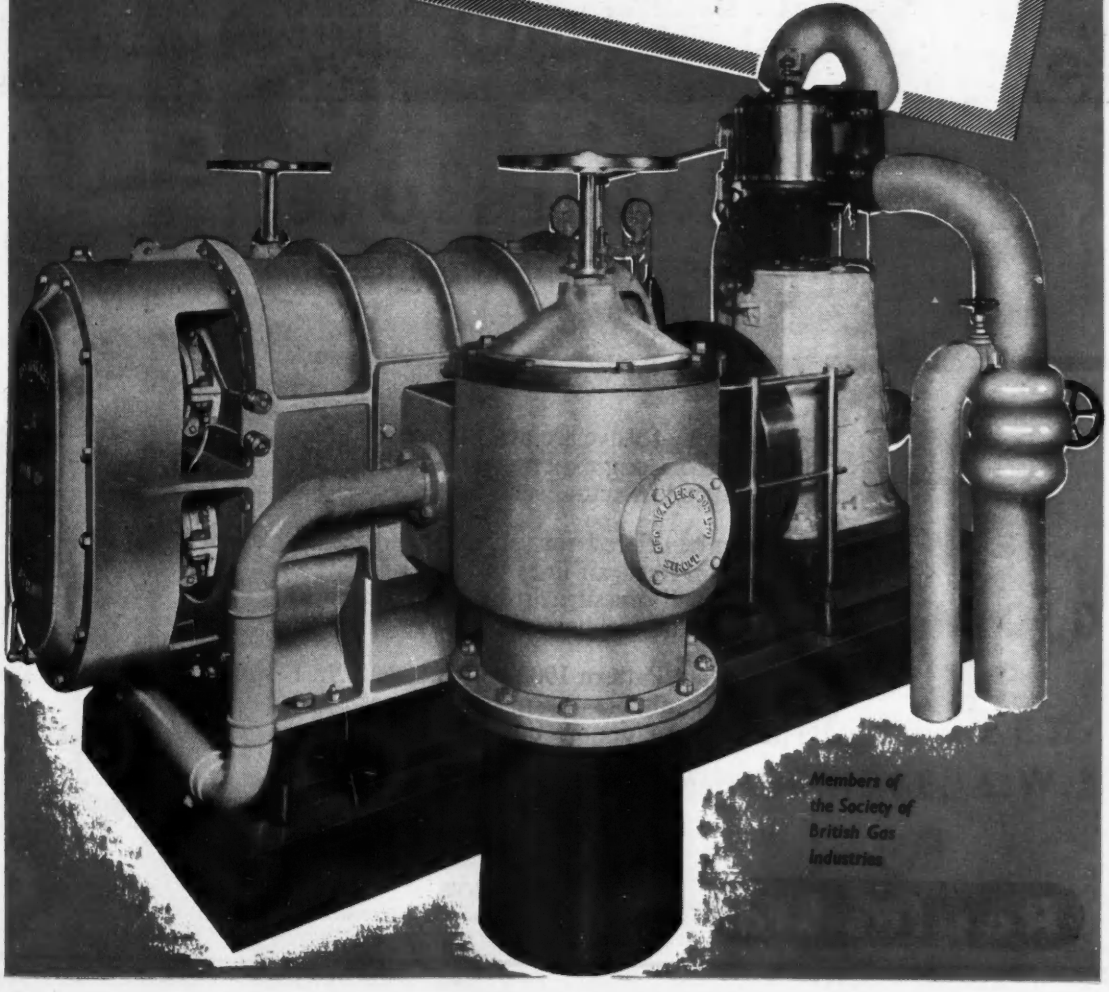

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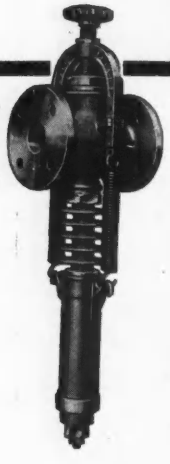

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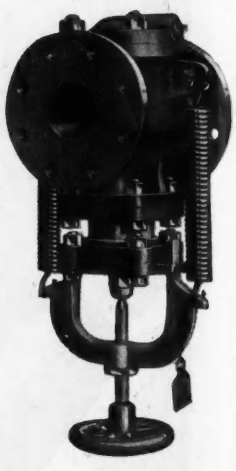

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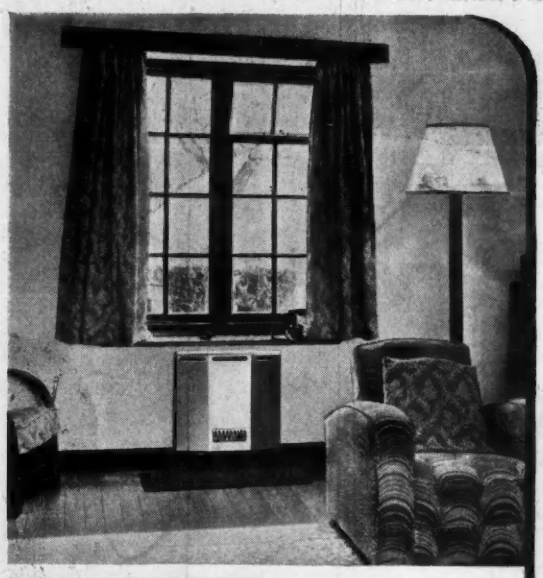

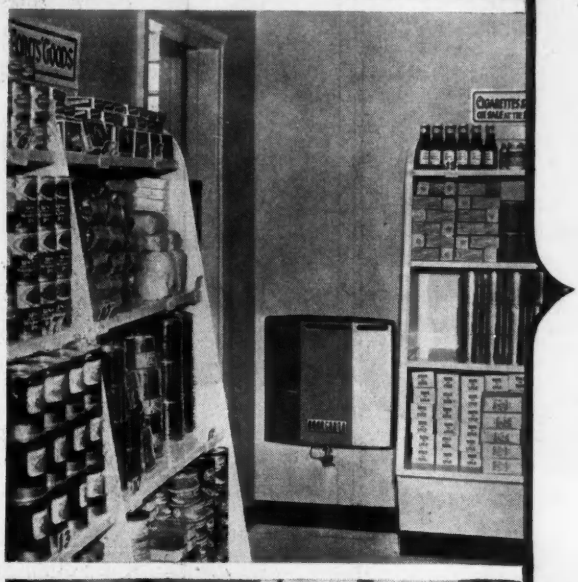

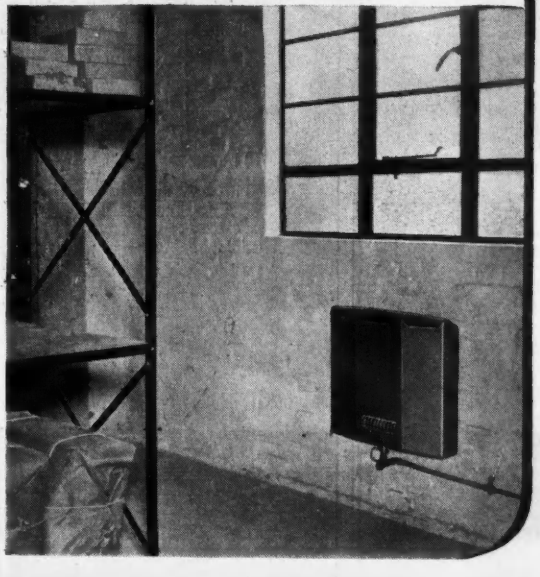

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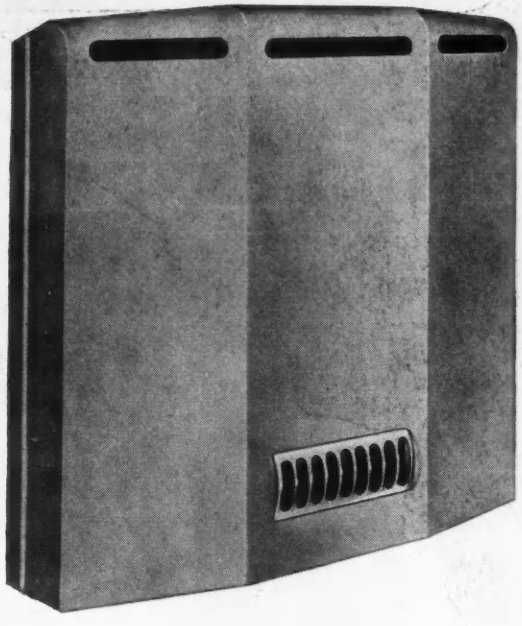

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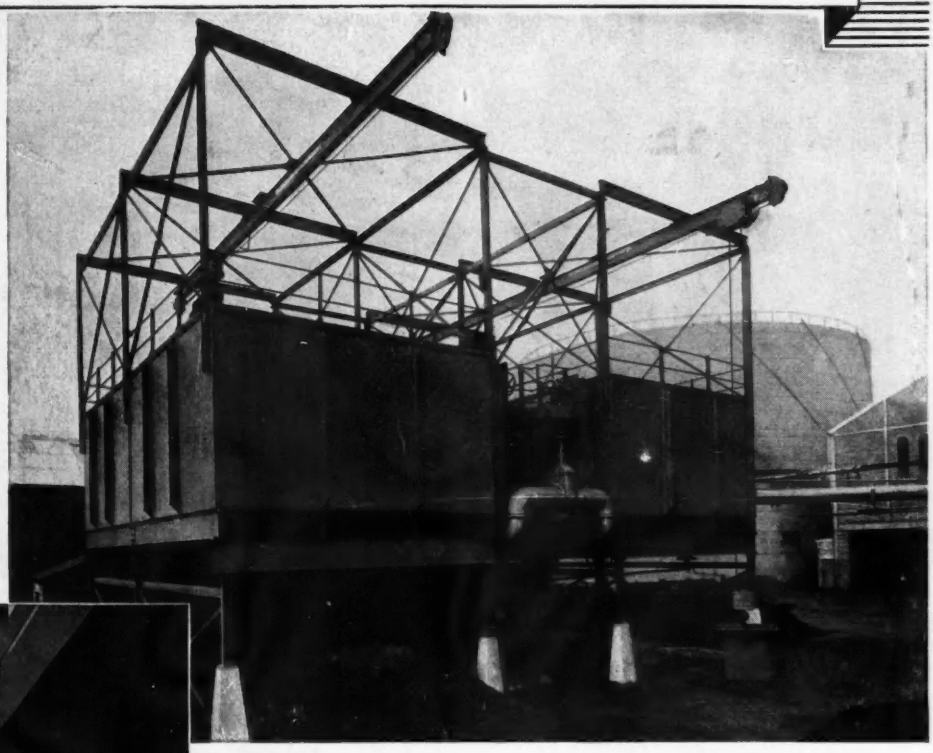

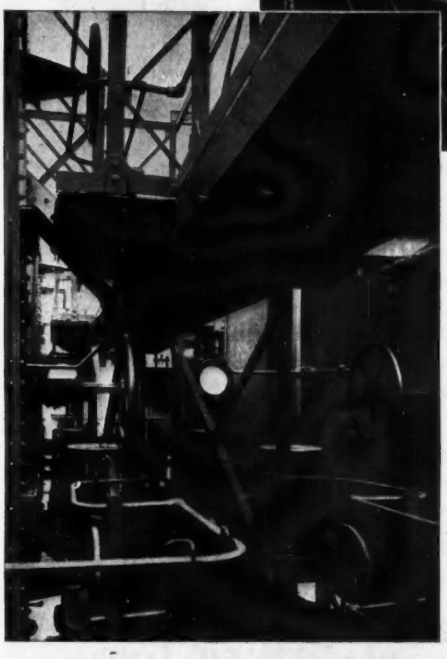

The illustrations show a 4-box set of Whessoe purifiers, each 18 ft. x 18 ft. x 10 ft., with a capacity of 1½ million cu. ft. per day, for the Ormskirk Undertaking of the N.W. Gas Board.

This is a simple installation with modern features—deep, welded mild-steel, overground boxes, with divided and reversible gas flow. Simple and efficient charging is provided by Morris 3-ton skips, operated by pulley-blocks, with hoisting and traversing controlled by an electrically driven winch, which is also arranged to provide for cover-lifting.

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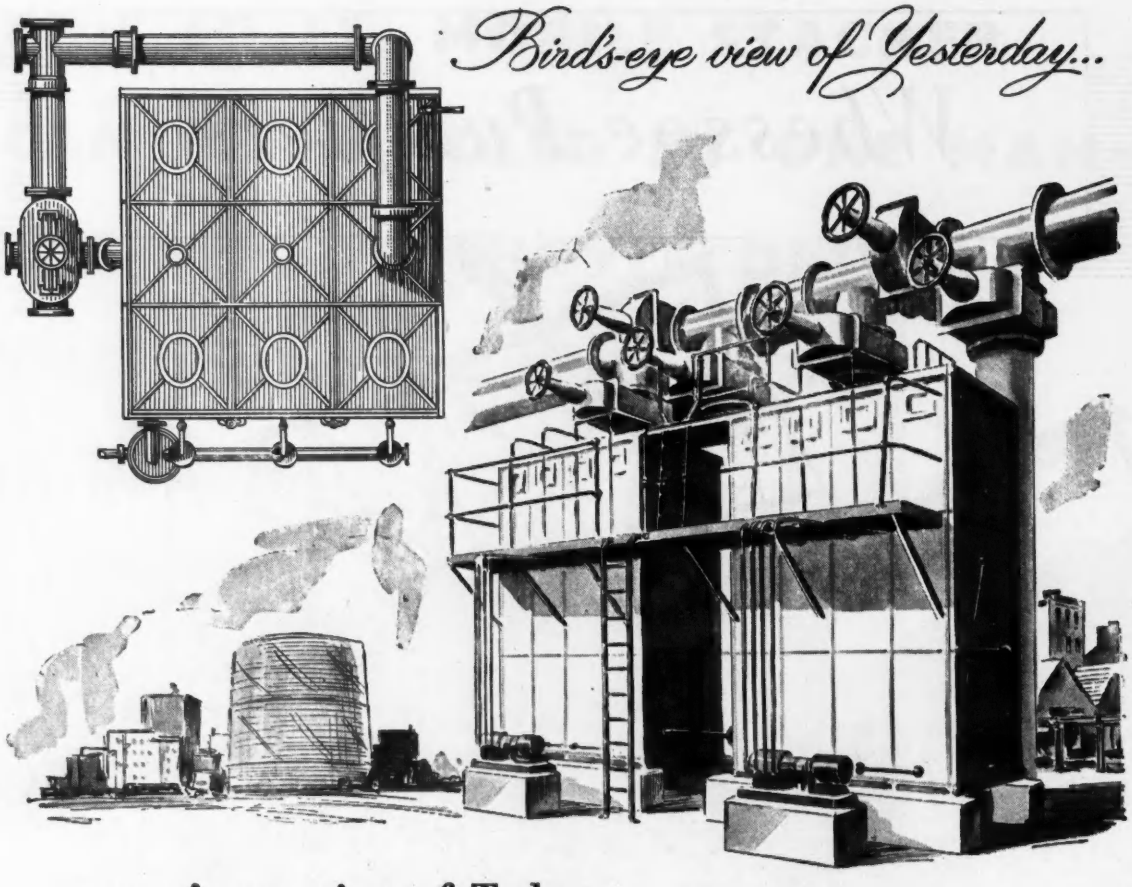

—worm's eye view of Today

Much of the history of gas-washing practice had been written before the early-type washer seen in plan in the engraving was put into service. In this—the first multi-stage washer—the usual oblong vessel was divided into independent sections to improve the overall efficiency of the plant. Multi-stage washers are widely used to-day since the flexibility of design enables them to be used for widely differing conditions. The Balfour multi-stage washer shown can be designed to any required capacity. It has been used for ammonia and benzole washing, and with slight modifications can be adapted for gas dehydration and napthalene removal.

The rule of thumb methods of the past for calculating the type and size of ammonia washer required are no longer suitable for modern conditions. Accurate data relating to the ammonia content, the percentage of carbon dioxide present, and the probable temperature of the input gas must be available. Static Washers, Tower Scrubbers, Livesey, Rotary and Centrifugal Washers all have their place in the modern gas works, and operating conditions must be carefully studied in order to decide on the most suitable installation.

The Balfour Organisation with its vast experience of gas engineering practice offers an unparallelled service for the design, manufacture and installation of complete gas purification plant.

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The period necessary for automatic opening after all taps have been closed, can be varied to suit any circumstances,

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MAIN COCKS

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SEE OUR EXHIBIT
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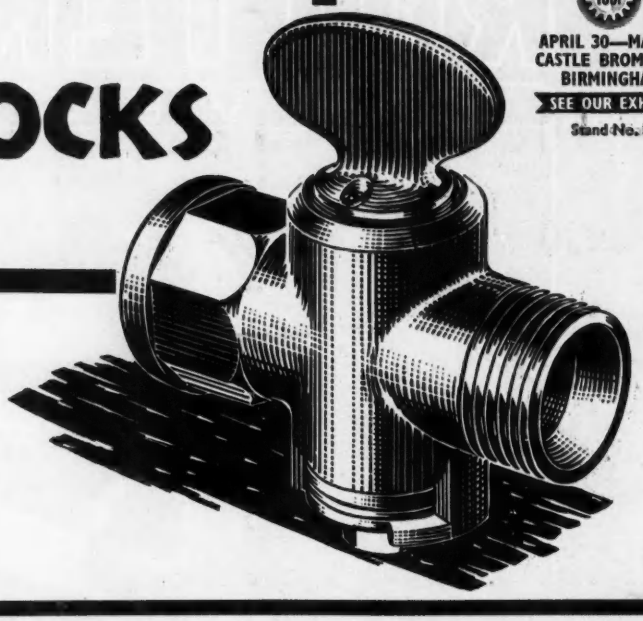

The "Spersom" patent Main Gas Cock has stood the test of time. It was the "Spersom" Cocks that pioneered the spring loading of gas cock plugs, to which has been added the self-oiling device ensuring constant lubrication.
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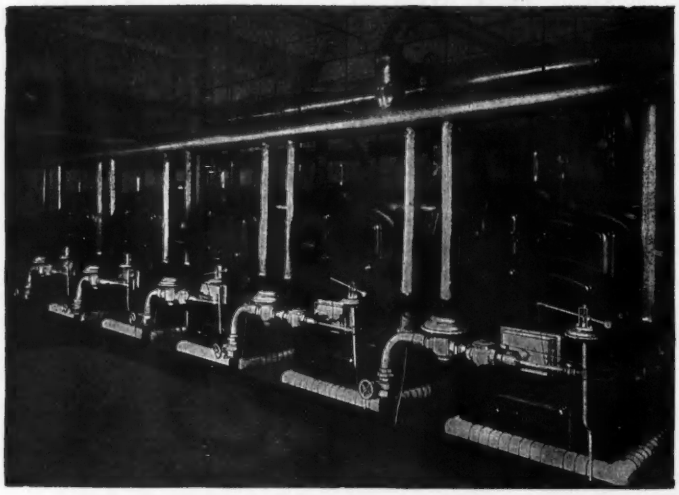

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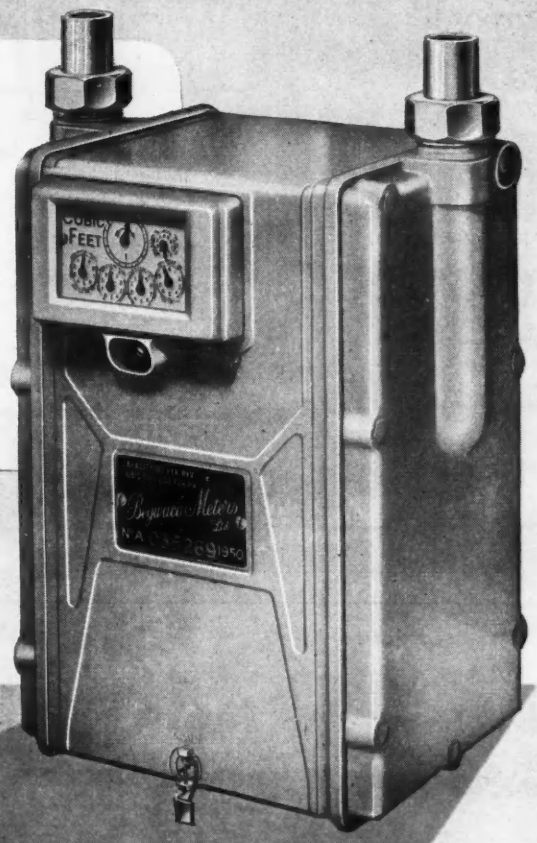

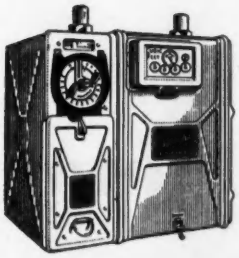

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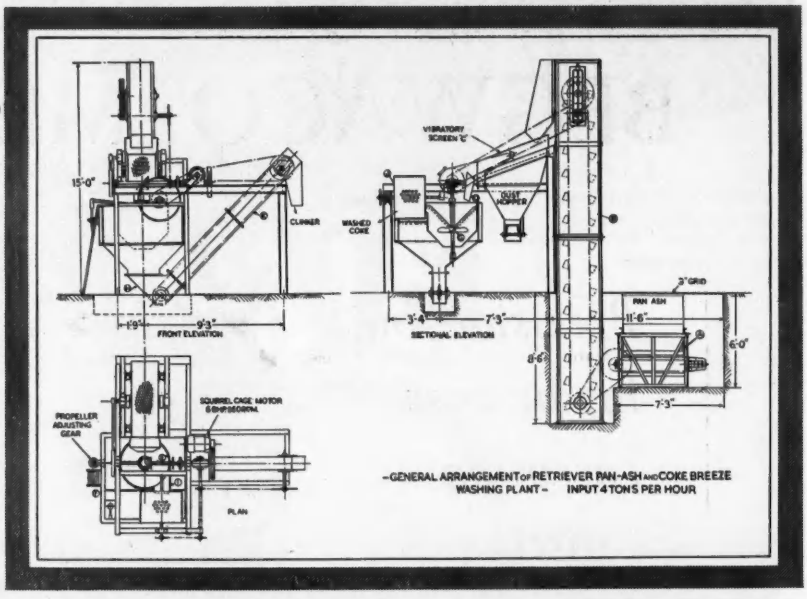

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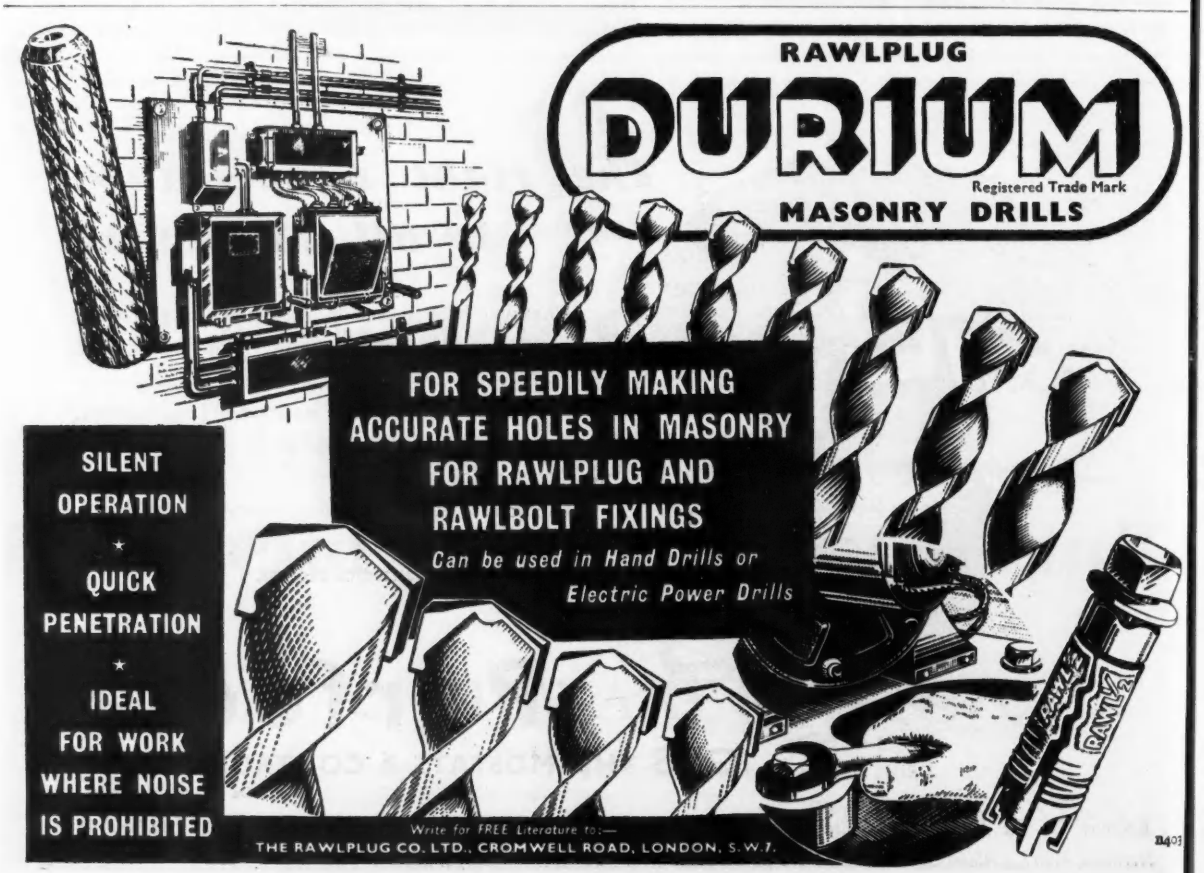

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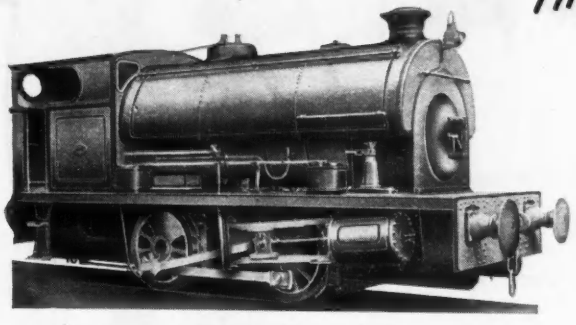

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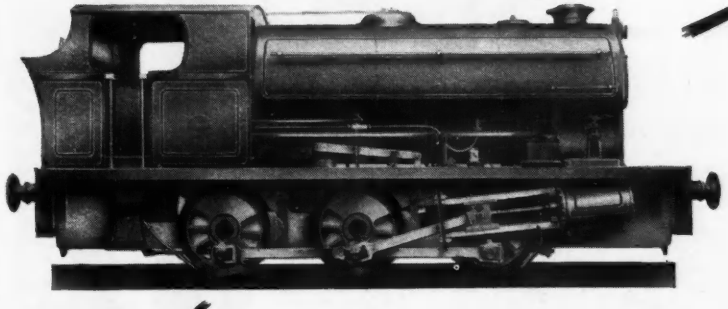
Weight in W.O. : 30 tons
As supplied to the Gas Board and B.E.A.



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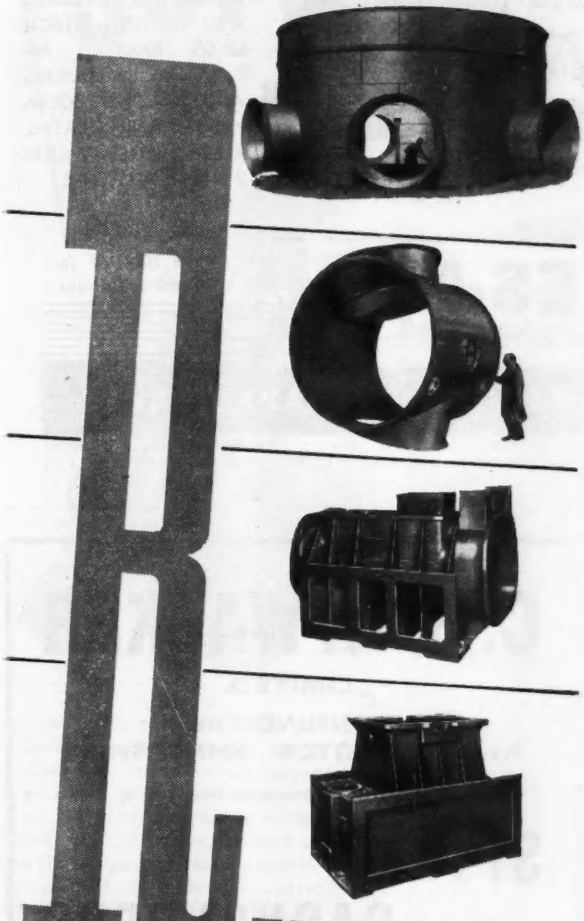

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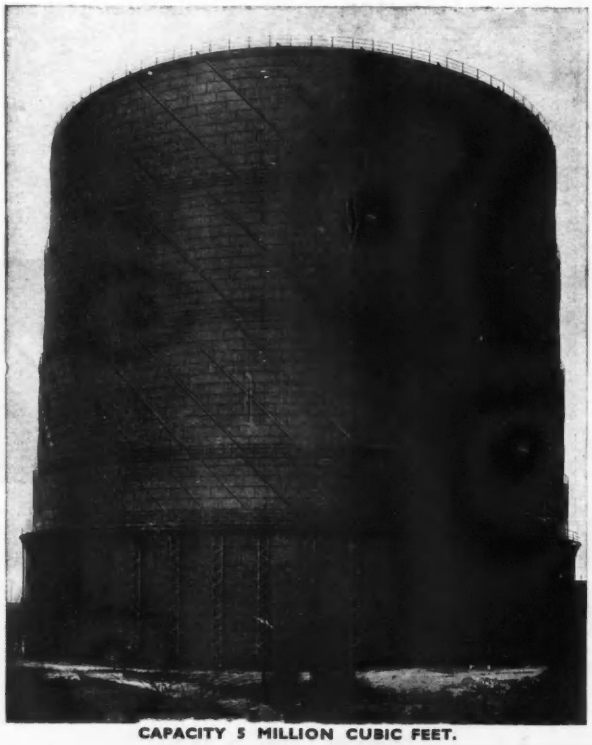

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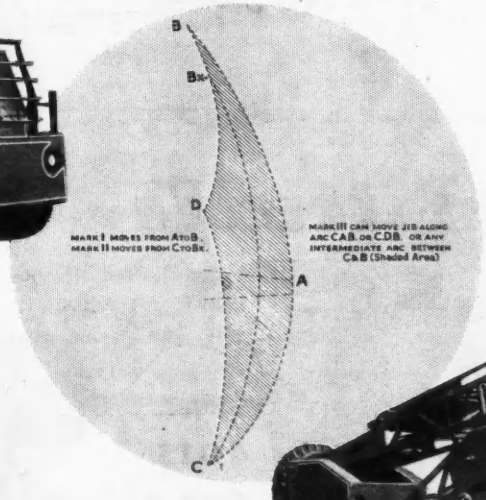
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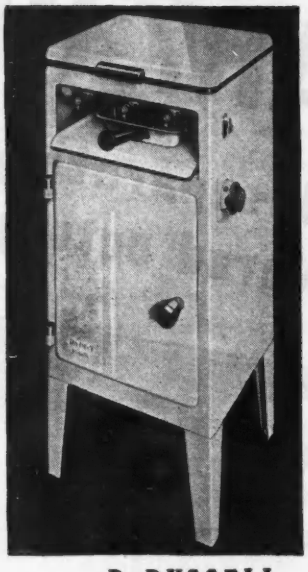

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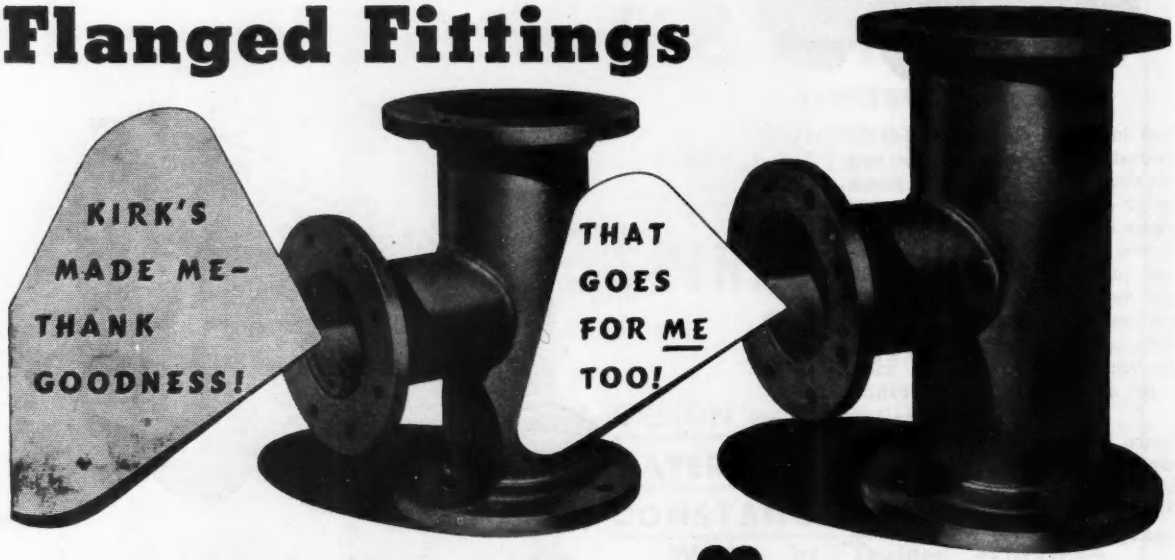

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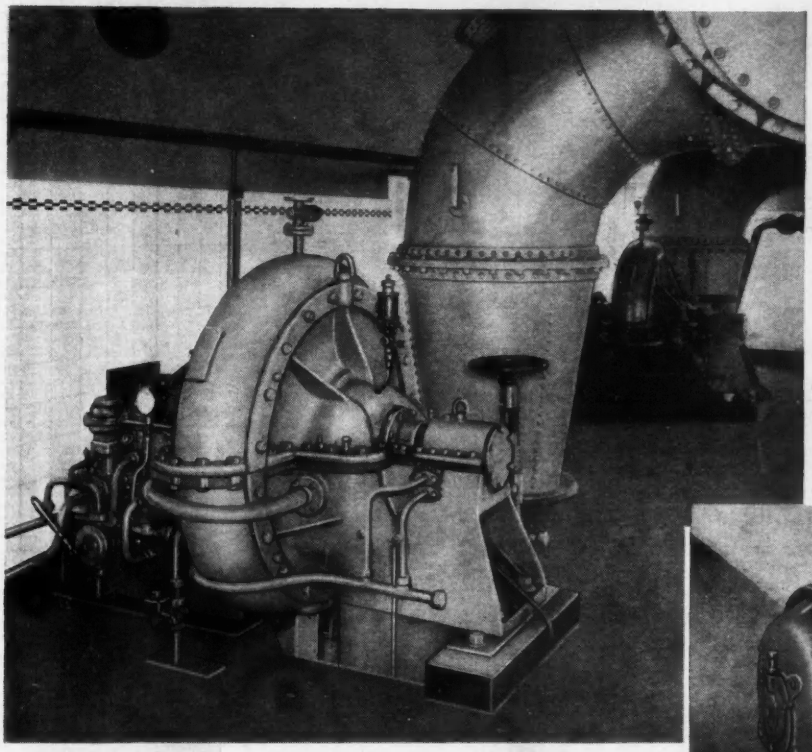

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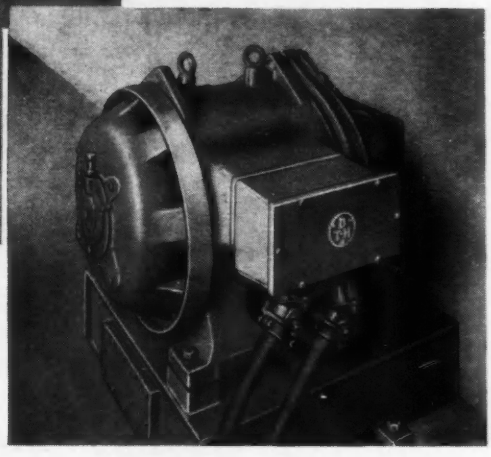

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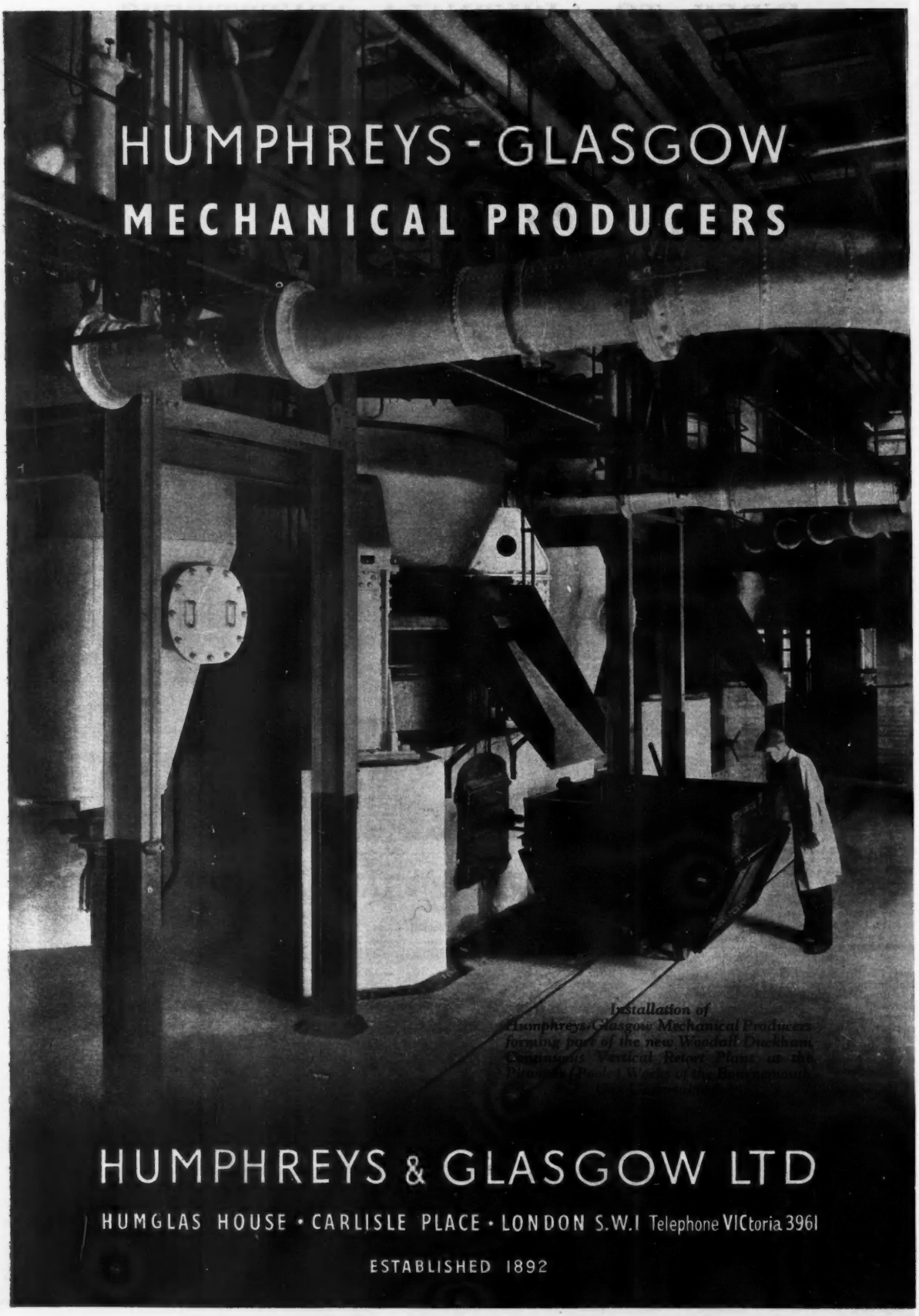
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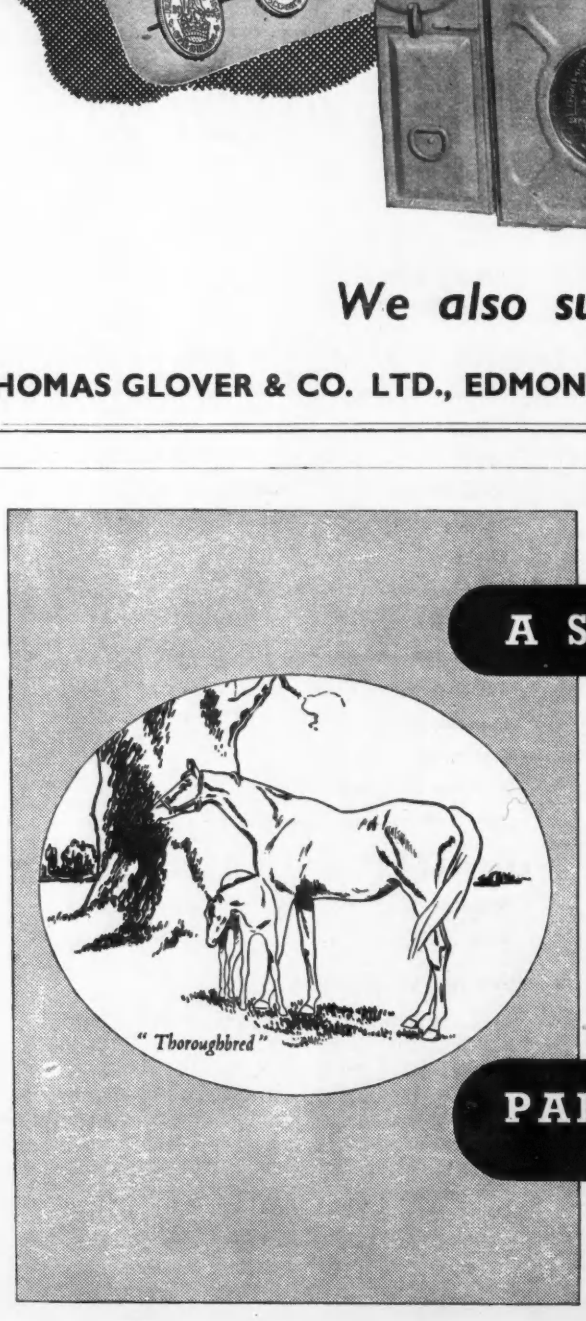

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GAS JOURNAL

VOL. 265. NO. 4582 103RD YEAR MARCH 28, 1951

RESEARCH

THE gas industry will be greatly indebted to Dr. King for his lucid exposition of the nature of research and of its classification under several types ranging from the pure, disinterested work of the individual scientist seeking for nothing but the satisfaction of his own scientific curiosity to the mere investigator of known phenomena. The word has become blunted in vulgarisation and it needed definition by a master, even though that definition showed the different grades of research merging into one another at their fringes. There is no positive dividing line between pure and applied research. Therefore Dr. King's classification in four groups had to be arbitrary. The greatest difference is between the first and the fourth, between research by taking thought, actuated by inspiration, motivated by the irresistible curiosity of the human mind, and operational research, observation of processes in operation supported by statistical analysis, which is only worthy of the name at all if it is undertaken in the true scientific spirit—not used, that is, to bolster up a prejudice but to discover the truth.

That Dr. King chose for the name of the highest form of scientific research, ' research by taking thought,' shows how difficult it is for us of ordinary clay to understand the workings of the highest form of scientific intellect. He did well to say that ' implicit in it is all that is understood by the word, inspiration.' These giants of the mind seem to look out on the cosmic processes, armed with a wide knowledge of what has been done and thought before them, with a master's insight into what is significant in it, and to see something that is not yet satisfactorily explained. Inspiration suggests an answer, and they never rest until they have rigorously proved or disproved its truth. These men are the flower of mankind. In modern times they can generally be persuaded to transmit some of their inspiration, their spirit, to their pupils.

It will generally be one of these who may be found to have ' the gift of assembling facts to produce visions,' and yet who will submit himself to the guidance of a wise and sympathetic director of research. This gift is not common. The gifted ones will not be produced with any certainty by any system of education or training. All we can do is to create the conditions under which the gift may appear and avail ourselves of it when it does.

To define the next grade of research was even more difficult. It seems to consist in pushing out the frontiers of existing fundamental knowledge by assiduous and steady work—continued study. But on the forward fringe of discovery may appear one of those fundamental advances which may elevate this research into the higher type. Like the higher type, it cannot be hurried; results cannot be predicted. And yet, as Dr. King's examples showed, some of the most tremendous developments of technique have followed from it. In these examples we see the same sort of inspiration (what may be vulgarly called the ' hunch ') as that arising from the possible parallels of silicon and carbon compounds. Dr. King's second example, that of atomic energy (he gave a most lucid summary of a vast subject), shows how this type of research ultimately fades out into technical development, into investigation and the application of scientific method to the solution of practical problems, to the elimination of difficulties which arise in practical operation.

We should be grateful, too, for Dr. King's account of the investigations of the processes of oxide purification and the recovery of sulphur. This is surely the first time that the whole picture of this patient work has been presented in, as it were, one view. Some day he will develop the theme of the eventual application of this research since it gives a complete directive to gas purification. His second example, that of high speed combustion of pre-mixed gas air in a tube, is an even prettier case of a successful step-by-step attack on a particular problem.

Operational research comes nearest to work that is done as occasion demands by the technicians in charge

of plant or by the scientific workers who stand behind them. It calls for the application of scientific method, the procession from the known to the unknown. And in this field, too, the workers are best trained in a school which favours breadth of knowledge before too early specialisation. In the long run young men trained in such a school will come quicker to effective work than those who specialise earlier.

In the organisation of research in our own industry we may look for changes, but it is to be hoped that Dr. King's views and advice will be kept in mind. Not only in the posing of problems can the technical and administrative leaders of the industry help the director of research, but in the application of results to practice, upon which so much of the discussion turned, it is to be hoped that the fruitful co-operation of the constructional with the operational engineer will be maintained. The work of the Department of Scientific and Industrial Research which Dr. King briefly extolled is built up on this co-operation. For its size and importance the gas industry should be more prominent in this work. The industry spends too little on research and pays relatively too little attention to its results. Recent announcements encourage the hope that in the near future the grounds for these reproaches will be removed.

ADVICE TO THE CHANCELLOR

NO man is the recipient, we suppose, of more gratuitous advice of all kinds and from all quarters than is the Chancellor of the Exchequer during the period immediately preceding Budget Day. Indeed, we ourselves unashamedly admit that we have joined in the popular outcry for a smaller impost on beer and for a very big tax on cats (particularly that ginger tom from over the way). We have argued vociferously and unremittingly the case for cheaper licences for our dogs and for vastly increased purchase tax on our neighbours' radio sets. But we have also considered in more serious light some of the suggestions put forward by leaders of industry and commerce, and by other responsible people, with a view both to easing the burden and at the same time assisting the country on to her financial feet—a very difficult and almost incompatible pair of objects.

The F.B.I. advocates that reserves for depreciation of fixed assets on replacement costs and for replacement of stocks at higher prices should be tax-free; that the profits tax should be withdrawn; and that there should be a shifting of the burden of taxation from production to consumption—in other words, from direct to indirect taxation. The Federation recognises that the present national emergency renders reduction of indirect taxation inappropriate but recommends immediate action to examine all the effects of purchase tax and the utility programme on industry and exports.

The Association of British Chambers of Commerce makes similar proposals as regards direct taxation, with particular emphasis on the necessity to stop the drainage of capital from business caused by taxing unreal profits. The difference between replacement costs and the historical costs of stocks and fixed assets should be treated as a current loss in computing taxable income. The Association adds its view that there is no cure for the profits tax, and it should be completely repealed.

The Federation of Wholesale Organisations has drawn Mr. Gaitskell's attention to the unfair incidence of existing taxation levels as it affects wholesale distribution. 'It is imperative that there should be some alleviation of taxation for wholesalers to enable them to finance the rising cost of goods.' The Trades Union Congress suggests adjustments of purchase tax—upwards on certain luxury goods and downwards on certain essentials. The T.U.C. also advance a very curious view on profits, and one can only hope that the Chancellor will not be swayed by such unwise counsel to increase the rate of taxation on distributed and undistributed profits and so throw a spanner of further disincentive into the works of British industry. There is a very general feeling that sweeping reductions in direct taxation, particularly in its application to industry, would lead to such an upsurge of optimism and confidence that would bring us nearer prosperity and stability than the present generation has ever known.

And lastly a post-script, as it were, from nearer home. The abolition of purchase tax on electric radiators fitted with approved safety devices appeared on the agenda of a recent meeting of the South Eastern Electricity Consultative Council. We suggest that this body of councillors should be aware of the impact of load shedding and the economical use of coal. The resolution, by the way, was postponed until the figures of accidents due to clothing fires caused by electrical appliances could be verified. Our own views on purchase tax on gas appliances have been put forward to successive, if not successful, Chancellors of the Exchequer, without, unfortunately for community welfare and benefit to the State, very much avail. Purchase tax is an easy revenue finder but a short-term policy, and there is grievous need for more flexibility in its application.

FEWER FACTORY ACCIDENTS

ACCORDING to the annual report of the Chief Inspector of Factories factory accidents were fewer and most industrialists were paying more attention to the safety, health and welfare of workers in 1949. Many employers were beginning to go beyond the legal minimum standard of safeguards and amenities, and employers and workers were giving more attention to the treatment of minor accidents and the provision and use of washing and first-aid facilities. Accidents recorded during 1949 totalled 192,982, of which 772 were fatal—a decrease of 4% in the number of non-fatal accidents and of 10.3% in fatal accidents compared with 1948. The total number of accidents is now just about the same as in 1939, after a steep increase during the war which reached its peak in 1942. The accident rate has been falling steadily since 1944, when it was 40 per 1,000. In 1949 it was 26 per 1,000. The three main causes of fatal accidents were persons falling (302), lifting machinery (94), and persons struck by falling objects (69). The Factory Department has resumed publication, suspended since 1939, of a series of pamphlets on accidents, how they happen,

and how to prevent them. The report states that there has been considerable progress in making factories brighter and more cheerful. Blackout paint from roof-lights and windows has been removed in most areas, new buildings provide the maximum amount of daylight, and lighting has made a big difference in artificially lit establishments. The idea of using colour 'seems to have become firmly established,' and there has been an increase in factory gardens. Progress has been made in allowing workers to sit while they work. But the report says 'some employers and workers think that sitting at work is a sign of slacking, and that standing has some moral value.' There was also an increase in the number of canteens. Plans for new factories almost invariably included canteens, suggesting that employers are coming to regard it as essential to provide food at the factory.

STREET WORKS CODE

FOR the assistance of officials of area boards, particularly distribution and mains engineers who will be primarily affected by the new street works code, a summary of the Public Utilities Street Works Act, 1950, has been prepared by Mr. Leslie F. Stemp, Legal Officer, at the desire of the Gas Council. The Act, as we remarked in our annual review three months ago, was the outcome of 25 years of negotiation in an attempt to agree a clause governing the breaking open of highways by statutory undertakers. One of the principal points at issue was whether the highway authority or the public utility undertaking should be liable in cases where a removal or alteration of sub-surface works was rendered reasonably necessary by highway reconstruction or alteration. When negotiations on this vital point broke down in 1939, the Government set up a joint committee of both Houses of Parliament under the chairmanship of Lord Carnock. The committee's report laid down certain broad principles, of which the most important was that the cost of removing sub-surface works 'should be borne by the party which initiated the proposal to effect the alteration of the highway which necessitated the removal or alteration of the apparatus and so entailed the cost.' Then the war suspended negotiations, but at the end of hostilities a new committee, with wider interests, was set up by the Ministry of Transport, to work out the details of a Bill to be introduced by the Government. The new Act is the result, and taken as a whole it is of great benefit to public utilities since it solves in their favour the contentious question of liability.

In a foreword to his summary, Mr. Stemp says the Act allows a wide margin of latitude for agreement between parties and no doubt in practice many matters will be covered by friendly agreements and mutual co-operation between the parties affected. He acknowledges the kindness of Mr. H. J. Escreet, of the North Thames Gas Board, in supplying model plans and sections which appear in an appendix to the summary.

Personal

Mr. J. C. Gaunt, Works Manager of the Calverley and Horsforth Division, North Eastern Gas Board, has been presented with an inscribed smoker's cabinet on leaving to take over a similar appointment at Huddersfield.

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Mr. H. R. Backhouse, O.B.E., has been elected Chairman and Managing Director of Mellor Bromley & Co., Ltd., and **Mr. H. B. Cufflin** has joined the Board of Directors. The firm is the parent Company of the Mellor Bromley Group, which includes Pegson, Ltd., Coalville.

Mr. A. Newing, A.M.I.E.E., Managing Director of Nevelin Electric Co., Ltd., has been appointed to the Board of Lancashire Dynamo Holdings Ltd., formerly Lancashire Dynamo and Crypto Ltd. The Nevelin company, specialising in the manufacture of glass bulb mercury arc rectifier equipment, has continued to expand since its inception by Mr. Newing in 1936, and is now one of the companies forming the L.D.H. Group. Mr. Newing is also a Director of British Electronic Products Ltd., another company in the same group.

Obituary

Mr. Samuel Moore, M.INST.GAS E., who has died at an advanced age in Belfast, had a more varied career in the gas industry than the majority of officials. Mr. Moore was trained in the Belfast Corporation Gas Department, and later become Secretary and Manager of Dromore Gas Company, Co. Down. Afterwards he was appointed Engineer and Manager to the Portrush Gas Company, Ltd. He next became Engineer, Manager and Secretary of the Scunthorpe (Lincolnshire) Urban District Gas Department. In 1912 he went abroad for three years, returning to reorganise the Arledon and Friginton gas undertaking. A year later he was appointed manager of Burnham and Highgate gas undertaking, a position which he held for 10 years. He retired in 1936 and returned to Belfast where he was the organiser of gas classes in the Municipal College of Technology for many years.

Diary

Mar. 29.—North Thames Gas Consultative Council: Westminster City Hall, Charing Cross Road, 2.30 p.m.

Mar. 30.—Gas Council Joint Consultative Committee: Gas Industry House. 10.30 a.m.

Mar. 30.—Northern Junior Gas Association: 'I.V.C. Plant at Cleveland,' G. Hamilton, Manager, Cleveland; visit to Cleveland undertaking.

April 3.—South Eastern Gas Consultative Council: Katharine Street, Croydon, 2.30 p.m.

April 3.—Institute of Fuel: 'Underground Gasification,' C. A. Masterman, at Institution of Mechanical Engineers, Storey's Gate, 5.30 p.m.

April 3.—London and Counties Coke Sales Circle: 'A Talk on Coke Sales,' G. C. Champion (North Thames Gas Board). Gas Industry House, 2.30 p.m.

April 6.—Institution of Gas Engineers (Midland Section): Annual General Meeting, Queen's Hotel, Birmingham, 2.30 p.m. (preceded by luncheon, 1 p.m.).

April 6.—Institute of Fuel: 'Integration of Gas Supplies in South Wales,' by a nominee of the Wales Gas Board; South Wales Institute of Engineers, Park Place, Cardiff, 6 p.m.

April 6.—London and Southern Junior Gas Association: 'The Rating of Domestic Solid Fuel Appliances,' Dr. F. J. Eaton, PH.D., 178, Edgware Road, W.2, 6.30 p.m.

April 7.—Scottish Junior Gas Association (Eastern District): Visit to Granton Gasworks, and paper by T. R. Cameron.

April 9.—West Midlands Gas Consultative Council: Victoria Hotel, Lichfield Street, Wolverhampton, 2.30 p.m.

April 10.—Chemical Engineering Group (Society of Chemical Industry): 'Man and the Chemical Industry; A Consideration of Physiological Adaptability,' Dr. M. W. Goldblatt, Geological Society's Rooms, Burlington House, W.1, 5.30 p.m.

April 11.—Institution of Gas Engineers and Low Temperature Group of the Physical Society: Joint Meeting, 'The Use of Stored Liquid Methane to Meet Peak Loads at Gasworks,' G. G. Haselden, PH.D., D.I.C., A.M.I.CHEM.E., and M. W. Reis, B.SC., A.C.G.I., at Institution of Mechanical Engineers, Storey's Gate, 5.30 p.m.

April 12.—Industrial Gas Development Committee: Gas Industry House, 9.30 a.m.

April 13.—Scottish Junior Gas Association (Western District): Annual General Meeting and election of office bearers, Royal Technical College, Glasgow. 5.30 p.m.

News in Brief

Scarborough Corporation has applied to the Ministry of Health for sanction to borrow £15,000 for the purchase of gas cookers.

An Exhibition on 'Manpower: The Human Factor in Industry,' will be opened on May 18 at the Safety, Health and Welfare Museum of the Ministry of Labour and National Service, Horseferry Road, Westminster, S.W.1. The main sections of the exhibition will deal with: Vocational guidance for young people; employment and advisory services; training and apprenticeship schemes; training and resettlement of the disabled; industrial health; industrial relations, joint consultation and personnel management; welfare; and safety in the factory.

Grimsby Coke Sales.—A black market in coke in Grimsby, which started during the recent cold weather, will, it is hoped, now come to an end following measures taken at Grimsby gasworks. Many of the people who queued at the gasworks for coke were found to be buying it and reselling at a large profit and one woman was even heard boasting of the amount of money which she had made in this way. Every applicant in future will have to give his or her name and will only be served at stated intervals with coke for personal use. No one will be allowed to fetch coke for another person.

Chemical Engineers' Examination.—Particulars of the 27th Associate Membership examination of the Institution of Chemical Engineers are now available from the Hon. Registrar at 56, Victoria Street, London, S.W.1. Application forms are returnable not later than June 1. Written and oral examinations will be held in September and home papers will be issued in January.

Stockton-on-Tees Corporation's representations to the Ministry of Town and Country Planning against a site selected by the Northern Gas Board for a gasholder at Portrack, Stockton, have been rejected. The Corporation has made a strong protest against the way the matter has been carried through. The Corporation protested that the holder would overlook a proposed new school. When an alternative site was suggested the Gas Board said it was not suitable.

Lecture Tour in Germany

Dame Vera Laughton Mathews has just returned from a fortnight's visit to Germany, which she undertook at the request of the Foreign Office to lecture at British centres and to German women's organisations. Her main lectures were on women's work in connection with the United Nations and on the status of women in modern life, but she also had the opportunity to speak to several audiences on her work in the gas industry. She visited the Berlin gasworks and showrooms and was present at a cookery demonstration. She was also entertained at lunch by the Directors and met some of the senior women in the gas industry in Germany. There is no woman actually in management, but a woman is head of the domestic side at the Central Gas Office for propaganda and is responsible for a number of interesting publications.

Losses on Nationalisation

Reference was made by Alderman A. E. Shennan, leader of Liverpool City Council, to losses in revenue sustained by the city as a result of nationalisation, when he presented his annual budget which called for an increased rate of 2s. 6d. in the £.

In 1948-49, he said, Liverpool lost the direct rate income of £377,000 due to the nationalisation of electricity and railways. In exchange it received a contribution of £266,000 so that there was a loss of income equal to 6d. in the £.

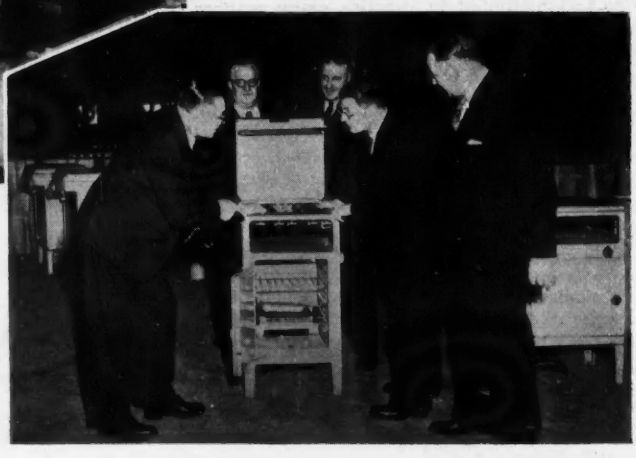
Now they were faced with a further possible loss having regard to the nationalisation of the gas undertakings.

Appeals had been lodged against the assessments of the old gas company which affect last year, the present year and next year. The Gas Board was asking for a reduction of 75% in the assessment, but even if the appeal was only partly successful the loss of rate income for the three years might be about £92,000.

They had lost, too, the annual contribution in aid of the rates of £100,000 which for some years was reasonably appropriated out of the profits of the electricity undertaking.

WEST MIDLANDS GATHERING

(Left).—*Coinciding with the publication of the West Midlands Gas Board report, copies of the popular version of which were available to those present, nearly 200 employees from all parts of the area gathered on March 14 for luncheon at the New Inn, Handsworth, Birmingham. Mr. G. le B. Diamond (Chairman of the Board) presided.*



NORTH WALES ENGINEERS AT RAINHILL

(Right).—*North Wales members of the Wales and Monmouthshire District Section of the Institution visited the Rainhill works of Stoves, Ltd., on March 7. Mr. O. P. Cronshaw (Rhyl), Chairman of the Section, and Mr. H. Blyth (Colwyn Bay) are here seen with Mr. R. Knight, Mr. P. Jackson, and Mr. J. Mercer (Directors of the firm).*

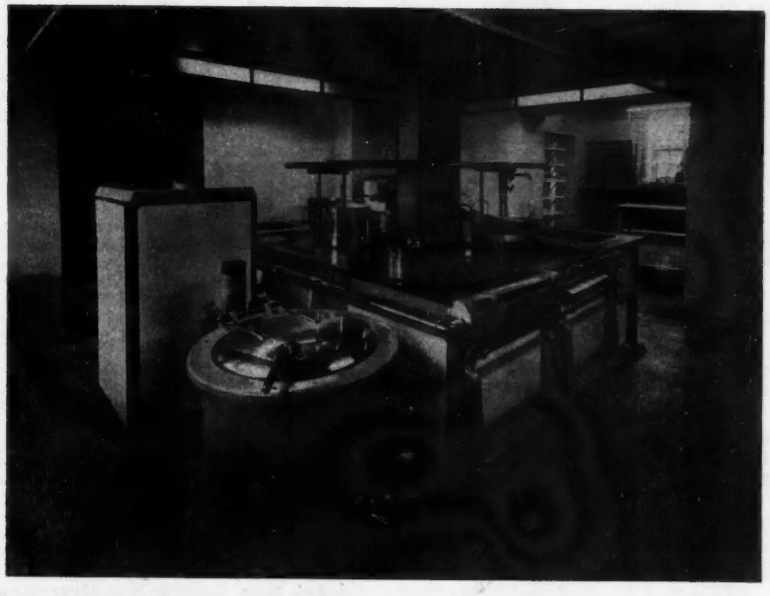
HYDRO HOTEL MODERNISED WITH GAS

The Kitchen Planning Department of the Torquay Sub-Division, South Western Gas Board, has recently re-planned and equipped the kitchens at the Hydro Hotel, which stands on a commanding site overlooking Torbay.

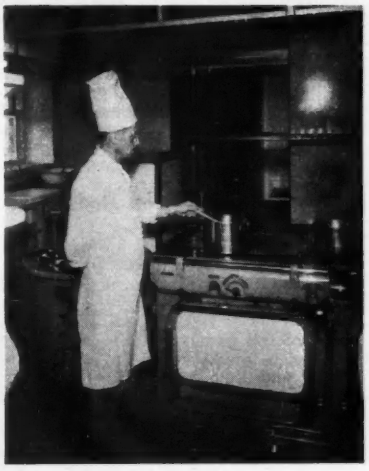
OWNED by the Torquay Hydropathic Co., Ltd., and managed by Mr. J. R. Collier, it was occupied during the war by a large London assurance company, but has now been completely reconditioned. Extensive alterations, improvements, and refurnishing have been carried out.

The following gas equipment manufactured by Radiation Ltd. has been installed:

Main Kitchen.—Four-oven 'Grosvenor' central pattern range with bain marie; 'Lune' vegetable boiler; 'Keswick' steamer; 'Chester' boiling table; stock pot stove; 'Savoy' C pattern griller.



General View of the Main Kitchen



The Chef de Cuisine at the Central Range

Still Room.—Electrolux L.1000 refrigerator.

Pastry Room.—'Whitemount' pastry oven and 'Chester' boiling table.

Servery.—10 ft. 'Belgravia' minor hot-closet with bain marie; 'Chester' boiling table; 'Savoy' toaster; and 'Jackson' tea and coffee set.

The result is a bright, airy, and spacious kitchen providing ease of movement and operation through every stage of food preparation.

In addition to the kitchen departments, all the public rooms, including the attractive cocktail bar, are fitted with gas ignited coke grates.

The Juniors in Wales

Pleasure at the public's reaction to the Wales Gas Board's report published earlier in the week was expressed by the Chairman of the Board, Mr. T. Mervyn Jones, on Saturday, March 18.

He was speaking at a joint meeting of the Wales and Monmouthshire Junior Gas Association and the Western Junior Gas Association at Cardiff, Mr. C. L. Singleton (President of the Wales Association) presiding.

In gaining achievements the gas industry was indebted to the loyalty, efficiency and enthusiasm of the juniors in their work.

'We in this industry are as weak or as strong, as progressive or otherwise, as you will allow us to be.'

In welcoming the Western Juniors to Wales, Mr. Jones observed that there was no iron curtain existing between area boards. The stronger the relationships between them the more sound would be the industry which they sought to serve.

Mr. F. W. Sansom (Exeter), President of the Western Juniors, responding to the welcome extended to his Association, hoped that a joint meeting might become an annual function.

CONSULTATIVE COUNCILS IN SESSION

Dearer Gas in the Southern Area

A SPECIAL meeting of the Southern Gas Consultative Council was held at Reading on March 14 to hear a statement from Mr. Owen R. Guard, Chairman of the Southern Gas Board, on the new schedule of prices to be introduced as from the first meter reading after March 19. The Chairman of the Council, Alderman J. W. Moore, presided.

Mr. Guard said the subject matter of his statement was not dissimilar to that discussed when last they met, save for the fact that the recent heavy increases in the prices of coal and wages, together with other inflationary tendencies, had a more far-reaching effect on the Board's economy than anything with which they had been faced before. They would, he was sure, appreciate that the increase of 4s. 2d. per ton in the price of coal to their various manufacturing stations was a tremendous blow to them, but to look only at the figure of increased coal cost, heavy as it was, without giving full consideration to the effect of this same increase on their ancillary undertakings and on other industries to whom they looked for goods and services, would be evading the real issue with which they were faced.

Re-Balancing the Budget

The first intimation he himself had of the increase in coal prices was the announcement on the radio on February 2 and on the next day they set out to discover so far as was practicable precisely what the full impact of these inflationary tendencies would mean in terms of money and then to see how best they could re-balance their budget, with as little hardship as possible to the consuming public and with a definite object of spreading the load fairly over the various districts and classes of consumers. They had hoped to maintain prices at the sort of level they were already on, but immediately they saw the increase in the price of coal it was obviously a physical impossibility to get anywhere near to this.

'When I spoke to you in June last,' added Mr. Guard, 'I said I was hopeful that we should at least be able to arrive at some reasonably standardised tariff structure for introduction in April, and had it not been for the very heavy preliminary work carried out in the Divisions at that time, our task would have been more arduous than it has in fact been. The divisional managers and their accountants have had a tremendous task.'

He continued that had he been asked in early January whether a tariff structure was still going to be possible for introduction by April, he would have had to admit that he was very doubtful. However, a block tariff incorporating standardised steps was in front of them that day. Owing to the different circumstances existing and the different types of consumers in certain parts of their area, it had not been possible to make the actual money steps identical without the creation of unnecessary hardship to certain classes of consumer. Although it might well be some years before it was possible to reach full standardisation, it did at least achieve the first important step of providing a fair basis for future price structure.

Mr. Guard asked that he should not be pressed too closely for a fully detailed statement on the increase in costs involved, for neither he nor his colleagues on the Board, nor for that matter the divisional general managers, felt that it would be wise to allow these figures to be published in too much detail at this particular juncture. He could say this, however, that taking into consideration, as they had done, the latest increase in the price of coal, recent additions to the price of gas oil, higher outside transport charges, the wages award of 1½d. per hour announced the previous week, a special provision for Civil Defence, and providing for inevitable rises in the cost of goods and services, together with the higher interest and depreciation charges which would follow from the obvious increase to their budgeted capital expenditure, they came to a total increased cost of approximately £700,000 per annum. That brought the total annual increase in costs outside the control of the Board since vesting day to no less a figure than approximately £1,400,000. He wanted them to have the facts, and in an area like theirs, which while wide geographically was comparatively small in production, the load per therm was very serious indeed.

Less Coke for Sale

In arriving at these figures, he continued, full consideration and allowance had been given to the increased revenue they might expect from the recent rise in the price of coke. But here they could not hope to receive the whole apparent benefit of the increase, because not only were they faced with the considerable rise in the cost of distribution brought about by the higher price of vehicles, petrol, oil and tyres, but what was more important, they knew that they would have to use more of their own coke for the production of carburetted water gas in order to save coal, with the consequence that less coke would, in fact, be available for outside sale.

'We feel, however, that the area is now in a sufficiently healthy trading position to carry some of the additional load of increased cost,' said Mr. Guard. 'As a result we feel that unless a new inflationary wave breaks upon us—and as the Chancellor of the Exchequer has recently said on the subject of inflationary tendencies "I do not think anyone can tell us when they are going to stop"—the addition of an average of approximately 1½d. per therm throughout the area, producing some £650,000 a year, will be sufficient to meet the situation for some time to come. I would emphasise here that I cannot say with any certainty how long coal prices, or for that matter any other outside influences will be stabilised. There have been hints that coal prices may yet be increased further. But it is on the assumption that some sort of stabilisation has now been reached that I am forecasting a reasonable period of steady gas prices.'

Half-Yearly Price Review

He added that the Board would shortly be considering the advisability of an annual or even a six monthly review of prices, so that the various requests and applications for changes in price might be considered at regular intervals against the background of the economies of the whole area. He felt that this would by easy stages take them without too much upheaval to their final objective of a minimum number of published prices throughout the area combined with a tariff structure fair to all classes of consumer. These things must be kept under review. Their job was not to make astronomical profits, but to try to balance their budget as near as they could. If they made a huge profit they would obviously be charging too much and ought to reduce their prices. If they did get benefits they should be passed on quickly, and any inflationary rises should be dealt with quickly, without any unfortunate time lag. In the past undertakings had reserves on which they could draw until they could bring in new prices. Such reserves were not now available to the Board. What reserves there were had been used for writing down capital expenditure and were never available for current expenditure.

The new prices, he added, had been arrived at after a careful and intensive study of the problems involved in each unit, and bearing in mind the integration plans that were in some cases complete and in other cases authorised and in progress. It was only fair to say that the conduct of the area during the last six months had not been easy. It had been necessary for the Board to re-cast in many directions a considerable amount of previously authorised schemes. He did not mean by this that they were not pressing on with development schemes, but that the effect of changes that had taken place, even during the past few weeks, in the general situation had been such that it had been deemed advisable, even at the risk of slowing down long-term plans, to think again, particularly bearing in mind the very great increases in capital costs, and, for that matter, in certain types of manufacturing costs. The situation had been made yet more critical by delivery dates being put further and further back on account of rearmament and serious shortages of material.

'We had in front of us,' he said, 'a

big capital programme, designed to close many of the small and inefficient works. In view of the appreciable costs and also of the serious delays we are experiencing in the delivery of raw materials, we may through force of circumstances have to keep a number of these comparatively inefficient works going for a considerably longer period.'

They would, added Mr. Guard, be interested to learn that the savings in shipping and coal handling costs were well above the estimates made, and already the three new vessels, *Portsmouth, Emsworth* and *Ardingly* were in full service. A further vessel would, they hoped, be operating by May, 1952. It was, however, a matter of great regret that he had to tell them that the Ministry of Transport had authorised an increase of 15% in the freight rates and an increase in demurrage rates of these larger vessels, which in fact almost completely nullified the benefits they were beginning to enjoy. For some reason which he was afraid was beyond his comprehension the smaller vessels were only to be subjected to an increase of 10%. It looked as if the big ships were now subsidising the small ones. While it was satisfactory that the steps taken had enabled them to absorb this further increase without increasing prices still further, it was a bitter disappointment that these operational savings should be thus dissipated.

Praise for Staff

Mr. Guard added that he could not overstress his appreciation of the efforts the Board's officials and employees had made since he last spoke to them. He particularly praised the way in which they had tackled the tremendous problems of the last few weeks, following as they did close on the heels of the strain of maintaining supplies during the recent cold spell. He concluded: 'I am sorry it is a gloomy picture. But the blame should not be laid on the people who are running this job. These things are completely outside their control.'

A number of questions were put to Mr. Guard. Councillor R. W. Jones asked if all districts paid the same rates for coal. Mr. Guard replied that the nearer the collieries, the cheaper was the coal. Councillor Jones suggested that the Council should pass a resolution asking the Minister of Fuel and Power to consider the charging of uniform prices throughout the gas industry. Many years ago they had this same sort of difficulty in regard to the supply of steel to the steel industries. It seemed to him that it was entirely unfair, particularly with a nationalised industry, that the southern part of the country should have to bear the whole cost of coal being sea borne and rail borne, as against those people who were living near the mines. He thought the Minister should consider some measure of uniformity in such charges.

Mr. Neil Gardiner opposed the suggestion, saying that he did not think it was practicable. Nothing would please him better than to see gas at a very much lower figure. But surely the whole basis of industry the world over was that they placed their factories in accordance with the best advantage for the supply of raw materials. If coal was the biggest raw material, then the factory was put near the coal mines, if it was steel then the factory went near the iron mines, and if it was flour or any other agricultural product, then it went in an agricultural area. But they could not have the best of all worlds. Why should factories in the south be subsidised by those in the north, for that was what it would amount to. They must allow the ordinary natural factors to play their part in the determination of price.

Councillor Jones pointed out that it was the policy of the Government to disperse factories as much as possible, and to move some of them from the bad areas. The Southern Gas Board was trying to produce a standardised tariff throughout the whole of its undertakings. That could only be accomplished by, say, the people of Bournemouth paying a little towards the cost of the people of Wimborne, or those at Southampton for those at Romsey. Here they had the opportunity of directing the attention of the Government towards the object of getting uniformity of price for coal.

Councillor C. Parsons supported Mr. Gardiner, though possibly on different grounds. The adoption of such a proposal as was suggested would open up a wide field. He considered it would not only have to apply the coal for the gas industry, but also to coal for industry generally, and for every purpose for which coal was used. It would inevitably mean that there would have to be a subsidy somewhere. Would the National Coal Board be subsidised, would the railways be subsidised, or how would it be devised? The policy of the Government was that the National Coal Board, the railways, the gas industry, should all stand on their own feet. He suggested that they should look at the matter from the point of view of the people who lived in the north. If the subsidy did not come from the Government it would have to come from those people. 'I do not think it would be fair to ask them to pay a proportion of the cost of our gas,' he concluded.

Councillor Jones asked if they were to assume that the farm labourer was to receive something less favourable than the worker in the town? After all, if they were going to give the service to rural areas it all ought to be on the same basis. He appreciated that under private enterprise they had to have regard to their capital investment, but when they came to nationalised industry he said that uniformity should be the basis on which they should work.

Mr. Guard stated that the Board's first step was to get uniformity at the point of production. On the question of uniformity of price, he thought this was bound to develop into a matter of national policy, and would have to be primarily discussed between the Minister and the Gas Council.

Answering another question, Mr. Guard said the Southern Gas Board had now got down to 13 basic prices, and they hoped as they progressed to get this down still further. When they took over there were over a 100 bases in the area.

East Midlands Increase

As we went to press we learnt that the East Midlands Gas Board had announced an all-round increase of 10% in prices charged to all consumers as from meter readings on and after March 26. The increase is expected to yield £1 mill. in a full year.

Protection Against Plumbers

Eastern Council Deprecates Faulty Fitting

DANGERS arising from gas installations carried out by private plumbers were among the subjects discussed at the meeting of the Eastern Gas Consultative Council, held at the Connaught Rooms, W.C.2, on March 19. The matter was raised when the Chairman, Mr. R. Turner, J.P., commented on a report of the Watford Divisional Committee. The report mentioned members' doubts concerning the desirability of plumbers' fitting gas appliances without the work being passed as satisfactory by the area board.

Certain of this work was not up to the standards of the industry, and in one case gas pipes had been fitted in such a way that an explosion resulted. The Committee had felt that it would be in the interests of the consumer if the board inspected or tested installations carried out by these private contractors.

The sometimes unsatisfactory quality of such work was endorsed by the Chairman, who said that he had had experience of water heaters being fitted with inadequate supplies, and the matter was taken up by several members. It was pointed out that when electrical installations were carried out, the authorities would not give a supply until they approved the work, and another member said that the matter should go to the Board in the form of a resolution, because it was felt that the matter was one in which life was literally at stake.

Appealed to by the Chairman, Mr. H. R. Hazeldine, Chief Accountant to the Board, pointed out that in the third schedule of the Act it was specifically stated that any employee could enter consumers' premises to inspect work, but the difficulty encountered by the Board was that in many cases they knew nothing of where this type of work was carried out or what was its nature. The point was quickly seized by a member who said that it was easy enough to pass such a resolution, but another matter to act upon it. What power was there to force either the contractor or the tenant to report on the work to be undertaken? Whose responsibility should it be, and what would be the penalties?

It was agreed, therefore, to refer the matter to the Board whose place it would be to say whether or not anything could be done to protect the consumers' interests, and there the matter was left.

The question of entry to consumers' property occurred in another divisional committee report—that of Cambridge. A letter had been received from Mr. Gilbert Longden, M.P., member for South West Herts., which stressed the desirability of board employees wearing uniform. On this matter the Chairman said that in his experience attempts to make fitters wear caps had proved unsuccessful, but on the other hand, no collector would be admitted to a house unless he wore uniform. One member suggested that gas employees should have a card which could be shown on request.

Another matter arising out of a divisional report, this time from Tottenham, was the complaint by a consumer who had had a sink water heater on hire which had been withdrawn because it was beyond repair; no replacement had been available on hire, only on hire-purchase. This was felt to be a considerable hardship and it was suggested that although hire terms might be withdrawn for these appliances, at least the terms should be extended to the maximum life of the appliance—as indeed would appear to have happened in this case. One member said he felt that the important point was that with hire-purchase, service was discontinued at the completion of payments; this could be a serious matter for a man earning only £4 a week. It was pointed out by other members that although water heaters were no longer available on simple hire, cookers and wash boilers were obtainable by this means.

One item on the agenda brought forth a long and interesting statement by the Chairman. This was the report of the Tariffs' Committee, which had considered the proposals of the Eastern Gas Board with regard to the provision of gas tariffs. Mr. Turner explained that the Board had held a special meeting to consider the Committee's proposals, and that in every case the Board had given way. It was true that the flat rate price had had to be raised, but instead of raising it to a uniform price throughout the area, the price had been plotted division by division. That idea had emanated from the Council, and the result was that by adding varying amounts to the prices ruling, a reasonable balance could be maintained.

The second point to be adopted was that the slot meter consumer should be given consideration. In the past, an increase on every therm sold had been imposed on the slot meter consumer, but the Council had felt that the differential should cease at a certain point of consumption. It was felt that outer area differentials should be abolished where possible. In an area supplying gas to an outlying area nearby, additional charges should cease, and this constituted a good step towards uniformity.

The two-part tariff for domestic consumers, though not generous, was an attempt to give the larger consumer some concession. The 446 tariffs now ruling would be abolished, and one simple block rate tariff for non-domestic consumers would take its place. There would also be a special tariff for bread baking, and he felt that this rate was a generous one when one bore in mind the cost of gas into holder at certain stations.

They recognised that the Eastern area was most difficult to deal with, having a large agricultural area, sparsely populated, and with small works which found it difficult to produce gas at a commercial figure. He felt, therefore, that some help should be given to the area in the matter of rising costs. In a comment on the Board's financial report, the *East Anglian Times* had stressed the number of new towns in the area where works were being erected and mains laid in anticipation of demand. Thereby capital was being employed in a manner which must be unremunerative for many years. For this reason the Tariffs' Committee had wondered whether the Minister would consider the establishment of an equalisation fund for the industry as a whole.

Another point which had arisen concerned the price of coal. There were remote areas in Norfolk and Suffolk which were miles from a coalhead, and the Committee had suggested that the position might be eased by the establishment of a uniform price for coal in the industry.

A number of other matters were raised during the meeting. One of these was a complaint on the part of a member regarding the rising price and falling quality of coke. The Chairman pointed out that the domestic fuel board was supposed to deal with this question, but admitted that it also came within the Council's sphere. Other items on the agenda included the price of gas at Felixstowe, the price of gas for industrial purposes at Stowmarket, the poor supply at Epping, and the admittance of the Press to meetings of divisional committees. Quarterly reports of tests made of gas for the quarter ended December 31, 1950, were received, and the Chairman mentioned that the Minister had agreed that consultative councils should have these reports, instead of local authorities as was the law prior to nationalisation.

Two new members attended the meeting—Councillor Lt.-Col. R. I. Musson, of the Tottenham Committee, and Councillor M. F. Jennings, of the Ipswich committee.

COMPANY NEWS

RADIATION LTD.

The trading profits of the group for the year ended December 31, 1950, as shown in the consolidated profit and loss account amount to £1,536,225. After bringing into account investment and sundry income and providing for depreciation, directors' remuneration, pension payments, etc., the profit for the year subject to taxation is £1,284,025. From the latter sum must be deducted the tax liability for the year (£724,375), leaving the net profit of the group for the year £559,650. The directors consider it advisable to set aside the further sum of £230,142 as an addition to the general reserve, and to transfer £30,000 to the pensions reserve. These amounts have been provided out of the balances accumulated on profit and loss accounts.

The allocations proposed are shown in the consolidated profit and loss account, the total distribution on the ordinary stock for the year, now recommended, being the same as paid prior to 1939. The profits earned during the year 1950 reflect the results of the increased output which has followed the policy of specialisation in manufacture adopted in 1949.

During the year Mr. T. N. Jennings has retired from the secretaryship of the company and at the request of the board has agreed to retain his directorship. Mr. J. I. Thomson has been appointed secretary.

SIDNEY FLAVEL

The cooker and gas appliance business of Sidney Flavel & Co. has made a strong recovery in the last year or two. Improvement has continued since the last accounting date, July 31. In addition to increased production of gas cookers, the company is now engaged, it is understood, on Government contracts for ammunition boxes, among other work. For the last financial period of seven months a dividend of 10%, equal to 17½% per annum, was paid. Expectations now are that the company will be in a position to provide shareholders with 20% out of earnings in excess of the 63% per annum rate secured last time. The 4s. shares are quoted at 7s. and would show a yield of over 11% on a 20% dividend. (Extract from *Financial Times*.)

RAMSEY

The directors' report presented at the annual meeting of the Ramsey Gas Light Company, Isle of Man, showed that gas sales were up by 250,000 cu.ft., and there was a considerable demand for coke which could not be met. The total sales of fittings and appliances (£7,644) were up by £1,084, and coke sales increased by 120 tons. It was reported that the plant had been well maintained and that one bed of retorts had been re-set and two further beds were in process of being re-set. A dividend of 40s. per share was carried.

POWERS-SAMAS

Powers-Samas Accounting Machines are maintaining their ordinary dividend at 45% by payment of a 27½% final. Group trading profits were slightly lower at £1,040,401, against £1,086,487, but tax provision of £340,000, against £450,000, more than offsets the fall. Sum of £225,000, against £195,505, is placed to reserve and the carry-forward is up from £113,596 to £121,333.

GAS IN THE HEALTH SERVICES

The above illustration is one of many in the Gas Council's new booklet, No. 2 in the series 'Commercial Uses of Gas'—entitled 'Gas in the Public Health Services.' It shows students under the supervision of a tutor at an Edinburgh training school for dieticians. The school provides first-class training for advanced students who wish to specialise in dietetic work in hospitals. The demonstrator uses one of the latest gas cookers, shown in the illustration at the side of the demonstrator's table. The students use another modern gas cooker so placed to enable them to work all round it. This school accepts trainee dieticians from all parts of the world.

THE public health services represent something very near to all of us in this 'welfare' state, and the man-in-the-street (who pays for them) is naturally closely concerned with how they are managed and run. Consequently, anything which suggests a means of greater efficiency or greater economy in their operation will have a wide interest throughout the community.

In its 'Commercial Uses of Gas' series the Gas Council is following a tradition which was built up before the war by the well-remembered B.C.G.A. publications—'A Thousand-and-One Uses for Gas.' The new series treats the subject more comprehensively, however, than the earlier publications were able to do and includes a variety of illustrations and readily understood facts and figures which must make a strong appeal to the reader.

It is hardly necessary for us to say that an important factor in the efficient operation and expansion of the public health services is the provision of up-to-date fuel-burning equipment for cooking, space-heating, and water-heating, or that the gas industry takes a leading part in this work. In this booklet examples are shown of the many appliances already being used in hospitals, sanatoria, clinics, mental and convalescent homes, and maternity and child welfare centres. Photographs illustrate the majority of these installations, and figures give their average gas consumption. The photographs include views of the Westminster Hospital, the Hospital for Sick Children, Great Ormond Street, the Middlesex Hospital, and other hospitals in both large and small provincial towns.

The appliances described include gas cookers for large hospital kitchens; boilers, either gas or coke fired, for central heating; gas fires and radiators; sterilising and refrigeration plant; incinerators; gas fired water heaters for clinics and dental surgeries, as well as for hospital installations; and laundry and laboratory appliances.

This booklet with its wealth of information about the efficient service which the gas industry is providing, should be of the greatest interest to all concerned, and the Gas Council is to be congratulated on a production of outstanding merit.

Facilities for Paying Acccounts

USEFUL information regarding meter rents was given by Mr. V. W. Stanton, Commercial Manager of the South Eastern Gas Board, to the General Purposes Committee of the Gas Consultative Council at Croydon on March 6.

The Committee accepted the Board's ruling that it was unable at the present time to arrange for domestic water heating appliances to be made available on ordinary hire terms.

The Minister of Fuel and Power had acknowledged a resolution relating to alleviation of purchase tax on essential domestic gas appliances; he had decided to bear this point in mind when such matters were under review.

The Council had previously approached the Board with regard to additional facilities for payment of accounts through banks. The Committtee, having heard the Commercial Manager's report, agreed that since these facilities were not being extended by the banks, the Board was not in a position to render any assistance in this direction.

Complaints received from consumers since the last meeting were considered and, by co-operation with the Board, satisfactorily settled.

A specimen leaflet for issue to the public was approved and it was decided to recommend to the Council that this form of publicity would be desirable. Advantage had been taken of the recent decision of the Postmaster-General to afford facilities for limited publicity in Post Offices within the area of the South Eastern Gas Board.

Modern Methods of

INDUSTRIAL RESEARCH

By Dr. J. G. KING, O.B.E., D.Sc., Ph.D.,
Director, Fuel Research Station

Separating the subject into four groups, the Author, in this paper to the London and Southern Section of the Institution of Gas Engineers, dealt with research by taking thought, by fundamental and continued study, by investigations and the application of scientific methods, and operational research.

THERE is today very considerable emphasis upon the need for research in the various fields of scientific endeavour, but there is, regrettably, a good deal of confusion as to what is meant by research as distinct from the applications of scientific methods to industrial or other processes.

In industry one aspect of this confusion has been the too frequent withdrawal of technical people from any attempt to obtain a close understanding of the methods which the research worker uses. I do not mean that they lack appreciation of the need for his work or of his results, but rather that they too often adopt the attitude of saying 'how the research worker functions is not for us to understand; let him get on with it quietly and later we can concentrate on his results.'

This attitude can have more than one bad result. In the first place, imperfect knowledge of methods and procedure may fail to make clear to the observer the final objective of the research and obscure the potentialities of the results as they appear during the course of the work. In the second place, it may tend to discourage technical people from putting forward problems for investigation. In industrial research, in particular, it is more often the technical man, not the scientist, who first recognises the need for work in a given direction and is best able to indicate where the research effort should be made. Further, it may be the industrial leader, rather than either, who recognises the general direction or trend of industrial progress, which, in turn, points a finger for research effort to follow. Thirdly, it may have the regrettable effect of investing the research worker with an air of mystery which is not in his best interests.

I felt, therefore, that some explanation of modern research methods would help to stimulate technical interest in them. Research covers, of course, a very wide field and I propose to apply my observations mainly to the field of industrial research since you are all concerned with an industry, and I wish to stimulate your interest in the research side of it.

I am sure you will understand that the applications of scientific methods to the control of a process or a plant is not research since the purpose is solely to maintain a predetermined state. In my opinion, it is a bad mistake to mix scientific control work and research work in the duties of an individual; one or both of them usually suffer.

It would be well to begin by discussing the difference between pure and applied research. One should say at once that there is no essential difference between the methods used, since in both they are those of natural science; or between the individuals concerned, since their training may well have been identical. The differences which do exist are mainly of viewpoint and procedure, not of method. The pure research worker is concerned with gaining knowledge and organising new knowledge, whereas the applied research worker is concerned with applying his scientific knowledge to problems having a definite objective. In the first case, since the objective may be indefinite, freedom of action is both expected and necessary, but in the second, a problem may be expounded and a solution expected in a more or less definite period of time. The first, therefore, requires thought and unlimited choice of resources; but the second may well reduce to the application of previously acquired knowledge, backed up by new confirmatory experiment. There is, of course, no positive dividing line.

Recognising these difficulties we may separate research arbitrarily into groups. I will omit consideration of the vexed question of the proper balance of work between groups which is appropriate in any industry, apart from saying that it is more natural for the balance to be in the direction of applied science in industry, and in the direction of pure science in the university and the research association. The groups I have taken are: (1) Research by taking thought; (2) research by fundamental and continued study; (3) research by investigation and the application of scientific methods; and (4) operational research.

In a complete picture I should add development, by which I mean the translation of laboratory work into practice and the solution of the problems which such a procedure involves, but I will not attempt it on this occasion. I would say, however, that development is the natural outcome of industrial research and should follow rapidly on the heels of new discoveries; if it does not it can have unfortunate effects in the form of discouragement which reflect upon the worker and reduce the rate of progress. I fear this under-emphasis on development is too common at present.

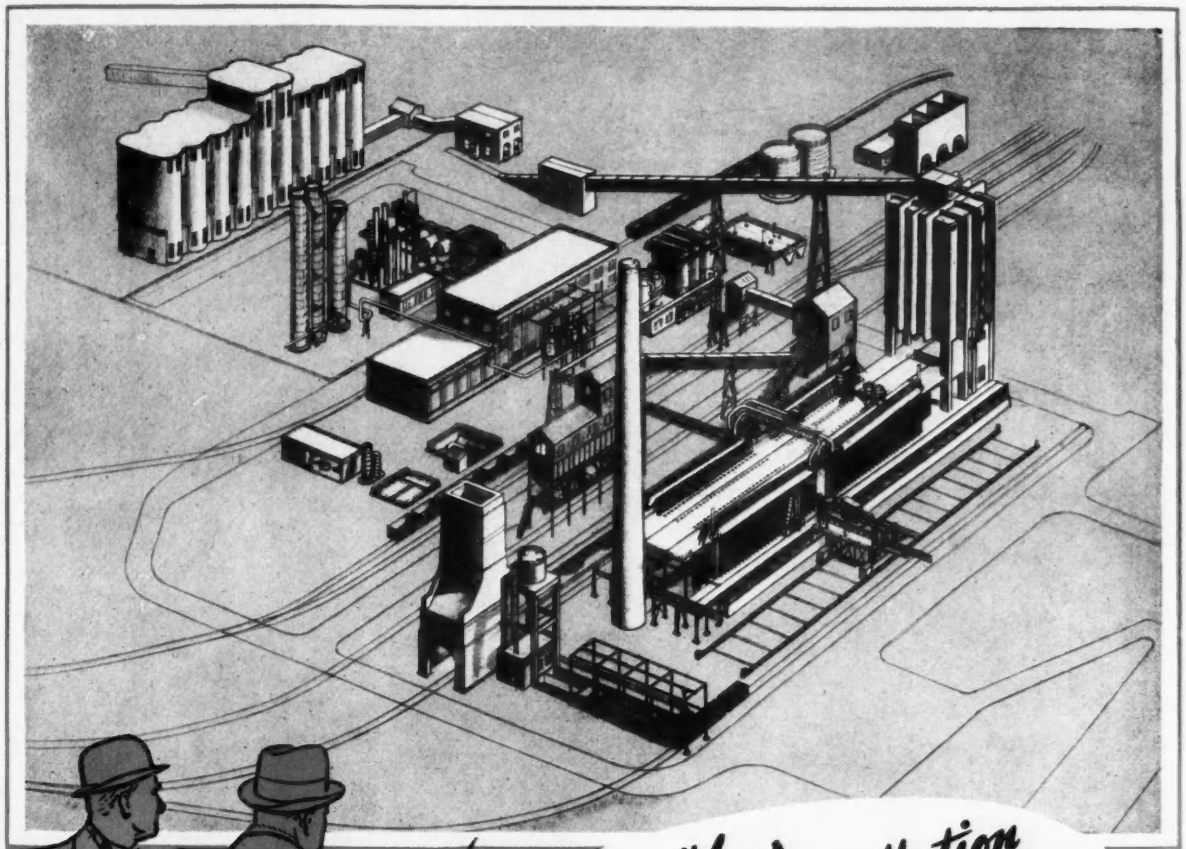
I will define what I mean by my arbitrary groups as I deal with each one, and will give you examples in illustration of the methods used.

Taking Thought

This is a form of research work which it is most difficult for the ordinary individual to understand since implicit in it is all that is understood by the word 'inspiration.'

Formerly—indeed up to the middle of the 19th century—there were still many basic scientific facts which were not known, and a great deal of the scientific research done was simply a search after these facts rather than their application to problems. In these times a great deal of scientific experimentation was done in which the study of results led, by inspiration, to the development of scientific laws which had general application.

We will go back to Isaac Newton (1642-1727) for an example. His only knowledge of astronomy was the vague idea that forces existed between heavenly bodies, a considerable volume of observations, and the empirical laws which Kepler had deduced from these for the movement of the planets. By continued thought and calculation, Newton distinguished three types of case which would have to be dealt with by anyone trying to prove that a single universal force determined the motion of bodies. These were sun and planet



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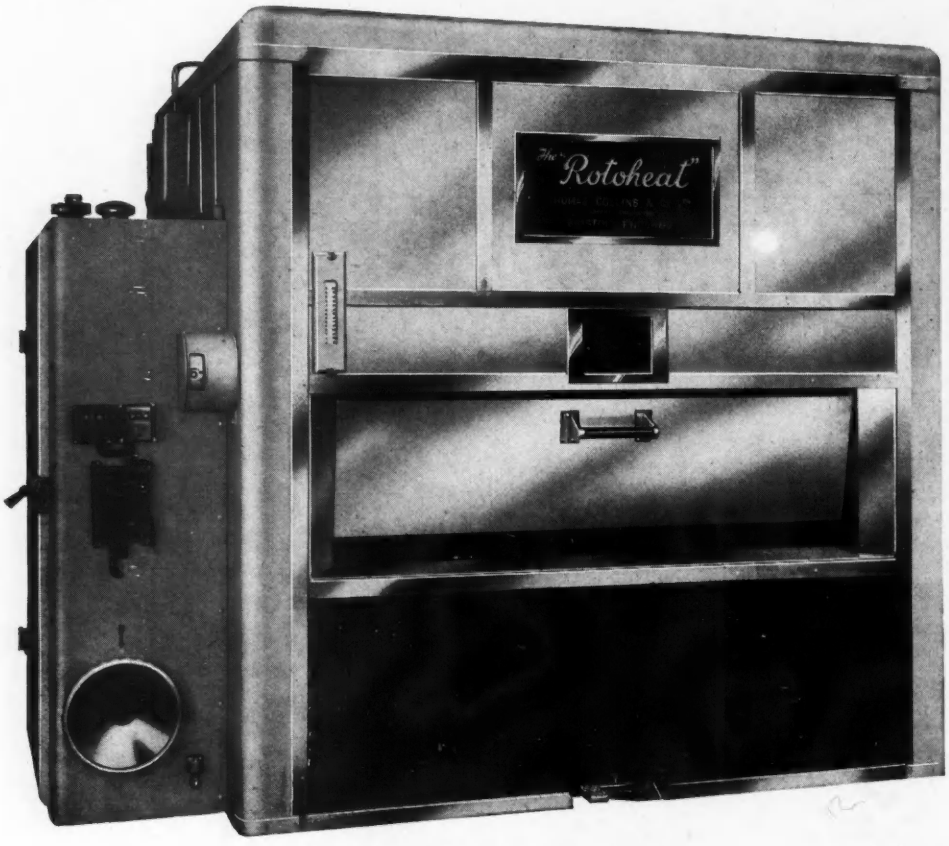

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(two point masses in space), earth and moon (two finite spheres), and earth and small body at or near its surface (sphere of large size). Newton first found that an inverse square law satisfied Kepler's empirical formulæ. Force $= G \frac{m_1 m_2}{d^2}$ where G is the universal gravitation constant. He then set out to calculate this force of attraction for all parts of a sphere at a given outside point, inventing, incidentally, for the purpose of his work, the method of mathematical computation known as the calculus. Eventually he developed a theory of motion of planets and the moon, and the lunar theory of tides, and defined concepts of mass, inertia, force, and their relation to velocity and acceleration. Thus emerged, for the first time, by the process of continued thought, a universal law governing the motion of bodies in space. This law still stands, although it has been extended for accurate work by the more complex theory of relativity.

I will take a second example from chemical science. In the middle of the 19th century organic chemists were aware of one group of substances of which the fats and fatty acids were representatives. It was realised that these 'aliphatic' substances consisted of linked chains of carbon atoms, some with side branches, and the starting point was a single carbon atom fully combined with hydrogen—*i.e.*, methane. A second group of substances was recognised, first by the arbitrary observation that they were of vegetable not animal origin, but progress in their study was held up because the composition of the substances did not correspond with their properties. For example, their composition indicated considerable unsaturation but their properties did not—*e.g.*, they were resistant to oxidation or chlorination. Taking benzene as an example, and after considerable experiment, Kekulé (1865) thought out a structure which would satisfy both composition and properties and arrived at the classic 'ring' structure of aromatic compounds which is still accepted.

This one step opened the door to an early appreciation of the structure of more complex aromatic structures; without it progress in this branch of chemistry might have been long delayed.

In all research of this type—taking thought or inspiration—it is very difficult, as I have said already, to define the actual mechanism which produces the result. It is very true that what is a very important step at the time may seem very simple as soon as it has been propounded. This simplicity is not real, however; in any group of scientific men there may be one whose knowledge may not exceed that of his colleagues but who has the gift of assembling facts to produce visions. This gift is not common, and any director of research who can find even one such man may consider himself lucky.

Fundamental or Continued Study

In this type of research the objective is generally quite simply the pursuit of new knowledge, but it is implied that there is a background of existing knowledge which is slowly and steadily being built upon. For many reasons this is the type most favoured by the university, and one finds many instances where one field only of work is studied for many years. Since one feature of such work is growth, a high proportion of it consists in the steady application of existing techniques, but on the forward fringe of discovery there is room for the thinker who, by an inspired move, may make a large advance in a short time. Often, however, this is not so, and the true magnitude of the achievement of this form of research is seen only in retrospect.

An important feature of such work is that it requires close study, both of the problem and of contemporary science and that its tempo should be unhurried. The industrialist often criticises it adversely as showing no results; but this can be unwise. As time goes on a use can be found and the fundamental work of today can often be the basis of the industry of tomorrow. This is very clearly seen in radio work and in the plastics industry.

As a minor example of steady growth, I will take the chemistry of silicon. From its position in the atomic table adjacent to carbon in Group IV it might be supposed that silicon would form compounds of the complexity and range which carbon compounds form in the whole range of organic chemistry.

Although the first organo-silicon compound was prepared by Friedel and Crafts in 1863 very few others had been made as late as 1900. At this point Prof. F. S. Kipping (Nottingham University) set himself the problem of proving that an asymmetric silicon compound had the same scope for isomerism as a carbon compound. By assiduous work for some 30 years (over 50 scientific papers) many silicon analogues of carbon compounds were synthesised.

This was how knowledge, built up by steady progress, opened up a new branch of theoretical chemistry, but it has led, as such work so often does, to an eventual practical application in the manufacture of one type of glass-like plastics (silicones) by the polymerisation of chlorinated silicon esters.

As my main example of the steady growth of knowledge I will take the proposed utilisation of atomic energy, which is very much in our thoughts today in relation to warfare. The story of this research starts with the enunciation by Einstein (1905), in the course of his development of the theory of relativity, of the equivalence of mass and energy ($E = mc^2$, where c is the velocity of light). This replaced the two fundamental principles of the separate conservation of mass and energy. From this equation it was evident that a small mass was equivalent to a very large amount of energy. Since mass of any matter is almost all in the atomic nuclei (in hydrogen atom nucleus mass = 1836 electron mass) it was realised that if by any means nuclear mass could be converted to energy, enormous reservoirs of energy would be available.

In 1896 Becquerel had discovered the phenomenon of radioactivity which was followed by the discovery of the electron in 1897 by J. J. Thomson. Radioactivity was extensively studied during the next 20 years with the result that the existence was known of a number of natural substances which decomposed spontaneously into other, simpler, substances with the emission of energy, partly in the form of α particles.

Up to 1919, no one had succeeded in disturbing the stability of ordinary substances or in affecting the disintegration rate of radioactive ones. In that year, Rutherford changed atoms of nitrogen into atoms of oxygen using naturally occurring high-energy α particles.

Within the next few years confirmatory experiments on these lines were carried out, particularly by Bothe and Becker in Germany and Curie and Joliot in France. Eventually Rutherford (1920) and Chadwick in England (1932) were able to explain the existence of the fundamental particles which comprised the atomic nucleus—*i.e.*, the proton carrying a positive charge and the neutron of the same mass but carrying no charge. In the same year one isotope of hydrogen, deuterium, was discovered. Isotopes, as you know, are comprised of atoms in which the nucleus has the same number of protons but different numbers of neutrons (Lead 206 to 214, Z = 82).

Also in 1932 Cockcroft and Walters produced nuclear changes by artificially produced, high-energy ions of hydrogen or helium instead of natural α particles. Incidentally in these experiments they obtained a good verification of the equivalence between energy and mass. Improvements in experimental technique allowed several other changes of this type to be discovered.

When the various fundamental particles combine to form an atomic nucleus, a 'binding' energy holds the combination stable. This energy may be measured as the equivalent of the difference in mass between the sum of the parts and the final nucleus. Expressed in the form of energy per particle in the nucleus, it is found that this energy increases with increasing atomic number and up to a flat maximum at

about Z = 28 (Ni) and then decreases again. Energy may therefore be freed by combining very light nuclei to form heavier ones or by breaking up very heavy ones into two or three smaller ones, all greater than Z = 28.

At this time, Bothe advanced a theory explaining the heat generated by the sun by a chain reaction, the net effect of which was that hydrogen was transformed into helium with the release of a very large amount of energy. This has subsequently been accepted generally.

The idea of utilising atomic energy was freely discussed but had remained theoretical because, up till then, the energy used in the laboratory experiments to liberate atomic energy had been very much greater than the energy released.

The bombardment of the heaviest element uranium 235 (Z = 92) by neutrons had been studied from 1934 onwards, but not until 1939 did it become clear that the nucleus under bombardment split up into approximately equal parts with the release of enormous amounts of energy—the process subsequently well known as 'fission.' This still required the application of energy in a relatively large proportion, and a further step was necessary to arrange for the contact of neutrons liberated in one fission to split other nuclei in a chain reaction so that there eventually resulted an enormous gain of energy. As you know, the combination of nuclei of an isotope of hydrogen on some scale has now been achieved also.

The final achievement now is to control the rate of release of this energy, and to harness it to power production—*i.e.*, technical development rather than research, although research must still play an important part in solving ancillary problems as they arise during development.

These two examples indicate how research, by continued study and fundamental experiment can, over a period of years, add continuously to knowledge, and in the end achieve results which may greatly transcend the original thought.

Investigation and the Application of Scientific Methods

In this type of research the worker is confronted with a problem not necessarily conceived by himself, but to which a positive solution is expected. If the scientific knowledge is already adequate he may deduce the answer by applying this knowledge and verify his deduction by simple *ad hoc* experiment. In this way he would arrive at a solution quickly. This is possible only if the worker is fully trained and the necessary scientific facts are available; if not, he must set out to establish them by continued investigation.

As one example of work of this type I will take the application of chemical research methods to the study of the purification of coal gas from hydrogen sulphide using iron oxide as carried out by Dr. Dent and Dr. Moignard, of the Gas Research Board (G.R.B. 52, 1950).

Two problems were at issue—(1) posed by the Sulphuric Acid Control of giving their industry not spent oxide but pure sulphur, and (2), posed by the gas industry as a whole, of detecting the causes of hardening of oxide and finding means for eliminating this.

The first and obvious step was to explore the differences in practice which existed and examine the results of this exploration. This was done in a considerable number of works, but only very general conclusions could be reached. The method of deduction and *ad hoc* experiment was not, therefore, allowable. The conclusions were:

(1) The arrangement of purification plant obtaining in the coke oven industry was advantageous in keeping tar of organic polymers (called tar) out of the oxide. Most coke oven oxides, therefore, gave pure sulphur when extracted.

(2) The re-arrangement of plant did not necessarily reduce hardening.

(3) Many different methods of operation obtained in the gas industry—box rotation, aeration, blending of oxide, humidifying of the gas, and reversal of flow. None was positive in avoiding hardening, but that hardening was avoided sometimes did suggest the existence of some underlying principle which would require determination by research methods.

The first step was to enlist the help of the microscope. Visual observation showed that the filling of free space by sulphur was not the answer to hardening. Hardened oxide showed a black continuous structure which chemical examination proved to be iron sulphide bonded with sulphur. This mass showed all changes of growth from a weakly interlocking mass to a hard dense material, firmly cemented together.

The next step was to study the reactions which could lead to such a hard deposit. This was done by considering the reactions separately of sulphiding and oxidation of the sulphide, under controlled conditions. It was found that if the moisture content of the oxide was maintained within certain limits the surface remained brown after oxidation, but if the moisture was allowed to dry out the surface became black and was subject to consolidation. This led to the theory that migration of iron oxide took place in the moisture film, the oxide migrating to the surface and the sulphur being retained inside the mass. Continued migration in this way was found to make available practically all the iron in the material.

The next move was to verify this. This was done by completely sulphiding an oxide under full control with intermediate oxidation in stages. The surface of the granules after a certain time was demonstrated to be β iron oxide, the removal of which by solution in hydrochloric acid revealed the sulphur deposit inside. Removal of the sulphur film by solution in carbon disulphide then showed ferric ferrocyanide deposited on the filler (wood shavings).

This step-wise research, therefore, revealed the exact reason why hard oxide was sometimes produced in practice and sometimes not, depending upon working conditions which did or did not control moisture content and which did or did not achieve complete oxidation before re-sulphiding. This investigation produced secondary results of value. In this case the most valuable was the indication that the β oxide produced by controlled operation in this way retained a high level of reactivity in the absorption of hydrogen sulphide, and, further, that high reactivity could be imposed by controlled change upon an initially-inactive material.

This work has been extended by further experimentation on the solvent extraction of oxide under controlled conditions and, with tar fog excluded, has demonstrated that this high reactivity is still retained after solvent extraction; this was a new fact. The sulphur extracted from spent oxides which contained tar can be purified by burning the tar out with oleum—an expensive and difficult method. It has now been found, by studying further oxidising agents, that the tar can be precipitated and filtered off without undue loss of solvent.

The eventual application of this research is not part of today's theme, but it should be pointed out that it gives a complete directive to gas purification: (*a*) to avoid hardening and (*b*) to recover iron oxide for repeated use and the sale of pure sulphur only. The directive is oil-washing prior to purification, humidity control with planned oxidation, solvent extraction, and return of extracted oxide. Three or four cycles of oxide return are indicated, but a large number could be achieved if ferrocyanides were extracted after every third or fourth usage. Since exact moisture control of a large static mass of oxide is obviously difficult, the work also points towards the development of a fluid process in which such control would be easy.

This series of experiments illustrates the planned application of chemical research methods to a defined problem, in this case fortunately with a successful result.

For a second example I will enter another field—that of physics—and indicate from a piece of work done by Mr.

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Howland and Mr. Simmonds, of the Gas Research Board, how an objective can be reached by the application of specialised techniques. Their paper will be presented on May 2 to the Midland Section of the Institute of Fuel.

This problem was to provide basic facts regarding gaseous combustion at very high rates in order to determine whether still higher rates could theoretically be achieved, and generally to help the further development of what was a valuable tool in the industrial use of gas. The system examined was that of the tunnel burner in which pre-mixed gas and air, in stoichiometric proportions, are introduced into a refractory tube. After the tube heats up the flame strikes back and most of the combustion occurs inside the tube; hot combustion products (circ. 1,800° Abs.) issue at high velocity from the end of the tube and can be directed upon objects which require rapid heating.

Gaseous combustion is a chain reaction and the ultra-violet emission spectrum of a normal flame shows bands which confirm the existence of stages in the chain. The first step was to determine whether this chain reaction was modified. It was quite an undertaking to put a burner of this output on a spectroscope, but it was achieved successfully using quartz windows in the tube to allow of the examination of the flame about 1 cm. from the mixture-inlet nozzle.

Differences were found—the OH bands (3,064° Abs.) were modified and the C_2 bands were of much lower intensity—indicating that the mechanism of the combustion reactions were different, but unfortunately the differences were not such as to indicate the nature of the new mechanism.

The outstanding characteristic of this tunnel, next to high thermal output, is the noise it produces. This was therefore examined next. A double-beam cathode-ray oscillograph was used, and the noise was picked up by a suitable microphone and recorded on one beam in comparison with a standard 1,000 cycle per sec. signal on the other. Intensity of noise was computed from amplitude. Simultaneous photography of both waves gave an exact measure of frequency which was about 1,000 cycles per sec. It was found that noise intensity showed marked maxima (× 30) at certain burner lengths, indicating resonance, and therefore the existence of a periodic phenomenon in the burner. From this it was a short step to the concept of explosions with a definite periodicity.

If this were true it was probable that visible evidence could be found in the (small) emergent flame. Now one method of observing at rest an object in rapid vibration is to use a stroboscope. One was built to suit and connected to one beam of the oscillograph, using the other beam to adjust conditions to ensure resonance. After adjusting the stroboscope till the flame appeared at rest photographs were taken by a cine camera. Eventually, visual proof of periodic combustion was found in the occurrence of intermittent balloons of flame projected from the tube.

Further visual evidence was obtained by using the Schlieren technique. Photographs of emergent flames showed at intervals violent turbulence with considerable lateral spread at the burner mouth, while hot gas showed a turbulent but gradually expanding stream.

Taking this evidence all together there emerge:

(i) That the high-speed combustion of pre-mixed gas and air in a tube is not continuous combustion but an explosion sequence of a periodicity of the order of 1,000 per sec.

(ii) The noise is associated with this explosion sequence and is not avoidable. Resonance, which may increase the noise intensity some 30 times, can be avoided by a suitable choice of burner lengths.

(iii) There is no theoretical limit on the observed rate of combustion of 200 million B.Th.U. per cu.ft. of combustion volume.

(iv) A residual investigation is to discover the method of initiation of the unit explosion—is it by heat transfer from the hot tube or the backward mixing of active nuclei? It is probably not catalysis.

This example illustrates a research method in which established scientific techniques have been deployed in solving a new problem. It implies, of course, a wide knowledge on the part of the workers and any research department which has many such problems would be advised to recruit from a university which favours breadth of knowledge before too early specialisation.

The two examples have, I hope, made clear what I mean by continued investigation and the application of scientific methods in the solution of specific problems.

There is another procedure which I should mention, although I doubt that it has ever been used in the gas industry—namely, the method of mass attack on a problem. If there are a large number of variables to be examined and there is no direct lead as to where to start, a very large number of parallel experiments may provide the answer in the minimum of time. This method was used in the early days of catalysts and before they were grouped, when large numbers of experiments were blindly conducted at the same time with different substances. This was done, to my knowledge, in determining catalysts for the hydrogenation of coal. A second example is found in the original search for anti-knock compounds for the petrol engine. It is not, in my opinion, a commendable method but it can have its uses.

Operational Research

The last group is 'operational' research. In any industrial process it may be possible to bring about improvements in ease of operation, efficiency, or cost, by taking observations during operation without attempting control of the factors involved. The statistical analysis of many collected observations may then reveal a weakness in the process or suggest procedures leading to higher efficiency. This should not be confused with the scientific control which is a relatively simple procedure aimed at maintaining, within predetermined limits, the technical conditions of a process.

The important aspect in operational research is the application of statistical analysis to a large number of observations. This consists in the mathematical treatment of observations in order to determine the effects of various uncontrolled factors which exist in a process, and to determine which of these effects are real. In the laboratory, where all factors may be controlled, it is usual to assess errors of observation in this way by determining the 'standard deviation' from the mean, which indicates the range in which the correct or true value lies. This is the most elementary form of statistical analysis; in practice, when the factors are not controlled, the form of the analysis becomes more complex.

I will take two quite simple examples from other fields than the gas industry; the first part of the oxide box work is another. A very simple one is provided by the Boot and Shoe R.A., which collected, over a period of years, measurements of thousands of human feet. Factory-made women's shoes had then only one girth for each size; the girth increase for each successive size was 6.4 mm. (0.25 in.), but no one knew how this increment had been obtained. Analysis of the new data showed the mean increment to be 3.8 mm. only (0.15 in.), as much as 40% less. The practical importance of this in shoe fitting is considerable, especially where the error has mounted in the larger sizes. Two results emerged from this analysis—(1) a precision grading for single-fitting shoes and (2) for multiple fittings a reduction in the number of alternative girth measurements and an elimination of the need for half sizes.

Operational research can, therefore, be simple in method but valuable in result; in this case it led to both improved service and economy in manufacture and distribution.

A second example concerns a unit procedure in the manufacture of steel and has been quoted by Sir Charles Goodeve. In the production of certain steel articles it had become the

practice to inspect and reject at the end of a series of operations. A close statistical analysis, confirmed by actual trial, showed that certain important faults leading to rejection could be detected at an early stage in the process. When this finding was applied, the proportion of rejects was reduced to less than half, and the number of final tests curtailed without any lowering of the standard of quality. The advantage in reduction of cost is apparent.

The Organisation of Research

I will conclude with some observations on the modern organisation of research. It is clear that the great mass of research work today is planned, that the research worker is well trained in scientific theory and even in research methods before he starts.

Planned research in industry is now almost entirely the solution of problems by concerted effort. The posing of these problems is probably the most difficult part of the organisation of research and usually falls upon the director of the group. It is here, however, that I have pointed out that the technical and administrative leaders can help for they know where many of the problems are; if they will only point them out, the research directive can do the rest.

The planning of the work will place it into one or more of the groups I have defined. It may be industrial or technological research from which the results can be directly applied, but in any research group such work should be supported by a proportion of fundamental work in which knowledge is built up, but from which results are not to be expected at any particular time.

There is another aspect of research direction—that of co-ordination with other work. All over the world new advances are continually being made and close contact must be established between workers in one field and elsewhere to make certain that full advantage can be taken at any time of discoveries in other fields which might be applicable.

This applies particularly in one's own country. I wonder whether you are fully aware of the large and growing scientific effort which is represented by the Research Association group of D.S.I.R. Starting in 1920 this has grown until Associations now represent 40 separate industries. The industrial income of these is £2 mill., which, with the D.S.I.R. grant of £1.1 mill., is devoted almost wholly to research. The total is expected to reach £5 mill. by 1952 and employ a graduate staff of 1,700. The very considerable scientific power of this organisation, and, incidentally, of D.S.I.R. itself, is available to any association director in consultation with other directors and must, in such consultation, be a means of reducing individual effort. I have made certain, for example, that the Gas Research Board acquired such contacts for the benefit of the gas industry. I regard co-ordination of scientific work, therefore, as an important issue; insularity in scientific work is just as unsatisfactory as it is in other walks of life.

DISCUSSION

Mr. L. T. Minchin said that one of the very interesting problems which had been raised by Dr. King was the relation between the research institution and the 'practical' man. If they agreed that long-term research (class 2 in the author's list), which aimed at a better understanding of observed phenomena, was the backbone of the research institution's work, they came up against the difficulty that such work was only justified after a considerable lapse of time. The 'practical' man was naturally inclined to grow restive and to wonder if his money was being wasted, and to clamour for practical results. A great act of faith was needed to make him wait ten years before he knew whether anything useful was being done. Sometimes it seemed as though the value of these elucidation processes which constituted 'fundamental' research were simply not understood by the industrialist. When some time ago Mr. Minchin tried to press for more research work on the faint luminescence which took place when some flames impinged on some solids, he was told that this was not worth investigating because the light produced was so faint. Yet this faint glow was an indication of a new mechanism in the reaction of a flame and a solid, and the importance of understanding fully what took place when flames struck solid surfaces could hardly be over-estimated.

Both in the realm of gas manufacture and utilisation there was a crying need for more scientific work, maintained Mr. Minchin. Recently he was investigating a new liquid purification process which was being developed in Germany by the Collin Company, and he found that a very thorough study in the laboratory of the physical chemistry of the system $H_2O-H_2S-CO_2-NH_3$ had been made by Eymann at Dusseldorf. This provided the basic data for working the Collin process. He would like to be able to think that wet purification processes in this country had a similar scentific background of research.

For its size and importance the gas industry spent very little on research and paid relatively little attention to such research when it was carried out. The meeting that day should be one of the occasions when, under the inspiration of Dr. King's address, they resolved to put this matter right.

Mr. W. A. Simmonds (Gas Research Board) took up the point made by Dr. King on the importance of the translation of laboratory work into practice, which was best done by a consideration of the complete picture. Under present working conditions industry's necessary development and growth could best be appreciated by its leaders. Problems and difficulties which might occur under these conditions could to some extent be foreseen in the anticipated development. These must first be appreciated and then defined. Such definition was made by the mutual efforts of the operational and research staffs and was probably the most difficult part of the process.

Scientific Explanations

The object of research, continued Mr. Simmonds, was to produce the solutions to these problems. These solutions were scientific explanations of the methods by which the problems might be resolved. There remained a highly skilled operation in transforming these solutions into forms applicable to the industrial process concerned. This was, in his opinion, the least developed part of the whole picture. It was important to realise that it was not part of operation or research and needed its own special staff, suitably trained and with the necessary background knowledge to appreciate the results of research and the operations of the industry concerned. The selection of staff with such qualifications was no easy matter. By the efforts of this staff the results of research were made an integral part of the production process. The logical consequence of this interaction of research and development with production was that a correct appreciation of the function of research and development by the management of an industry was essential to its efficient functioning. Only then could the whole cycle of problems being handed over to the research side and solutions received back from development occur to the best advantage. It was probable that the lack of appreciation of the function of development was the reason for the statement, which was sometimes heard, that research in a particular field had produced no results. What this often meant was that no development work had been applied to the results of research—and, consequently, the results were not in a suitable form to apply.

Dr. Coxon observed that Professor Kipping's investigations covered the field of silicon chemistry most ably, but he was an academically trained scientist and did not take out a single patent for his inventions—with the result that although he pioneered the way it was left to an American company to take out patents in this country. In consequence, we were now in the anomalous position of manufacturing silicon under American licence.

Mr. J. E. Davis remarked that one thing was common throughout all this class of work. It started with the man who said, 'I do not believe it,' and who went on working until he found out whether it was true or not. It was natural for people to publish the results of their work for others to see, and sometimes somebody else who read those results realised that substantial advantage could be gained by applying them to his own industry. The gas industry was not quick enough in taking up new ideas and applying them to their everyday jobs.

Dr. G. E. Foxwell said he did not think the position of research was yet fully understood in industry. If they looked back over a hundred years of commerce they would see that the purpose of commerce was to buy and sell for the benefit of the nation. The object was to find places where there was a surplus and move that surplus to other places where there

was scarcity. The position was now changed fundamentally, and they were faced with the necessity to produce a surplus which some one wanted. That could only be achieved by research. They were in a strong position in the gas industry in that the Gas Research Board was the only body in the country which linked together the contractors and was responsible for all major developments. This was something very precious, and it was linked with the Department of Scientific and Industrial Research. They had a vast fund of help which was very important to development. But, asked Dr. Foxwell, was the gas industry really supporting the Gas Research Board and the D.S.I.R. as it should? Prior to nationalisation the Gas Light and Coke Company had a very fine laboratory where they undertook research in producing something they wanted—and they had research men in responsible positions in the industry. They had the organisation for research, and they must be ready to try out the results immediately on the works.

THE AUTHOR'S REPLY

Dr. King, replying to the discussion, said he found it interesting that, while he had rather avoided the thorny problem of the rapid development of research ideas, the speakers had all stressed the importance of this. He was indebted particularly to Mr. Simmonds for stressing the correct attitude towards development. He agreed that the only thing to do was to have a separate department which would receive research ideas and, in association with industry, carry them to the next stage. In some industries there was undoubtedly all the development effort necessary to carry research data forward as quickly as it was produced, but this was not true of the gas industry.

Mr. Davis and Mr. Minchin had uttered the same plea for more rapid development, while Dr. Coxon had evidently the same thought when criticising the failure of Professor Kipping to realise the value of his discoveries in the field of silica plastics. Dr. King said, however, that Dr. Coxon was not quite right here, since the research scientist was not necessarily the right man to carry his discoveries into practice; an active development group in direct touch with both research and development progress was the right answer. In Mr. Simmonds's words, what was wanted was an organised body to expedite the cycle of problems—research—solution—application. It was this lack of development work which had led to criticism of research departments which, though they had built up a considerable store of research knowledge, had not attempted development.

He was glad that Mr. Minchin had appreciated his plea for closer liaison between the technical man in industry and the research scientist. If this, and similar meetings, did make resolutions to further such contacts something would surely be achieved in time towards this end. The important function of the research department was to store up a surplus of research data as Dr. Foxwell had said, but the development section must prevent this data from all being put on the shelf. As regards the Gas Research Board and the development of its work, the direct reply to Dr. Foxwell was that none had been developed so far except through the Board's own efforts, but the development of certain projects were not under consideration by a development group.

Vote of Thanks

Dr. S. Pexton, in proposing a vote of thanks to Dr. King, said the author had stated that he could not include mass attack in the gas industry, but he wondered whether or not the large amount of work and effort on the problem of nitrogenous gum might not be put into that class.

Mr. P. C. Gardiner seconded the vote of thanks which was warmly accorded.

Dr. King thanked Dr. Pexton and Mr. Gardiner for their expressions of appreciation; he was glad the meeting had found the paper interesting.

MODERN BAKERY PRACTICE

Mr. G. A. Manasseh, of Baker, Perkins, Ltd., Westwood Works, Peterborough, gave an address on 'Modern Bakery Practice' to the Midland Junior Gas Association at Birmingham on February 27. The President (Mr. J. Palser) occupied the chair.

IN his talk Mr. Manasseh showed a coloured film illustrating a completely automatic bakery plant such as is in use in many up-to-date bakeries today; and later, by the aid of an epidiascope, projected other illustrations of gas fired ovens on the screen. Dealing with modern examples of travelling plant, he pointed out the advantages and improvements which they incorporated. As a salesman who had spent many years on the machine side of the bakery industry it was only natural that he should deal with bakery equipment from the engineer's point of view. As far back as about 1865 Mr. Loftus Perkins pioneered a small bore high pressure system of heating bakers' ovens, and just about the beginning of the century his firm developed the drawplate oven with a wide mouth. This oven was coke fired, and later the coke fired travelling oven was developed by Mr. Joseph Baker. The first Perkins swing-tray oven was gas fired in 1914, and Joseph Baker brought out a tunnel type oven about 1917. This particular oven was direct gas fired, with the flame in the baking chamber.

There followed many developments in travelling ovens until the oven as they saw it to-day emerged. It might be of interest to them to know that some of the ovens first made by Perkins were still at work. These, of course, were only single-deckers; practically all modern ovens were two-deckers, but some had four and five decks. The standard two-deck drawplate oven would consume at maximum round about 1,000 cu.ft. of gas per hour for the two decks. It did not matter in the least whether it was an old oven converted, or a brand new oven, the construction was virtually the same, providing the old ovens had modern separate small furnaces.

Another type of oven was sometimes combined with a drawplate bottom and a peel top. Before the war Baker, Perkins, Ltd., developed a gas fired oven which had no furnace in the ordinary accepted sense of the word. It had no brickwork in it, and he believed it was one of the most economical in gas consumption which they had put on the market. This oven was a two-decker, and each deck was independently controlled. The gas inlet was on the right—they could be left or right handed; the thermostat was at the side; and the jets were in slots across the front. The gas burners were housed in a cast-iron block and were of refractory type.

Showing illustrations of a range of gas fired ovens, from the type in use by the small baker to that employed by large plant bakeries, Mr. Manasseh pointed to one of the latter which had few parallels in the world, and would produce 11,000 2 oz. cobs an hour, and was run for 20 hours a day. It was, however, a very difficult thing to say exactly how much gas a baker was likely to use. It all depended on the sort of oven, and how much a baker worked it. A big plant baker, using his ovens 24 hours a day, would use a therm and a half to a sack of flour. But a baker with a drawplate oven or a peel oven, who worked it about six hours a day—having it standing idle for 18 hours—would burn about four therms, perhaps even five therms, a sack of flour. It was, however, difficult to give accurate figures. Unless they were plant bakers, he thought 1½ to two therms was a fair average. In plant bakeries there was very little tolerance possible, and the plant baker had to be very careful with his temperatures, even calculating how much temperature increase his dough had brought about.

Dealing with another oven, Mr. Manasseh showed an illustration of a burner of which he said his firm was extremely proud. It was one of their own, and was so interlocked that it was impossible for even the veriest novice to do any damage through any default. A dial was provided, with a light burning throughout at the top; and the operations were so interlocked that the person in charge could not switch on the gas until the light showed, and he could not even do that until his main was on. The burner was so effectively interconnected that his firm had never found that any baker using this oven experienced any trouble with it. The furnaces went right across the ovens from one side to the other; they were flexible in movement, and the hot gases were taken through the back by stainless steel ducts. There were two fans, one for each furnace, which fans circulated the heat round the oven through the radiators. One fan looked after the front part, and the other fan operated for the back part, of the oven.

DISCUSSION

Mr. Foxton (Cheltenham) mentioned that he had read in a London paper a complaint by a baker about the cost of baking by gas. It was said to be costing four times as much as before his ovens were converted from coke burning. He imagined it was largely a question of how the oven was used. There must obviously be some relationship between the size of a man's business and the cost of gas as to whether it would pay him to have ovens converted. He had been concerned with ovens which had been converted from coke to gas, and quite a lot of trouble had been experienced. But they traced this to the fact that these bakers were working their ovens in very much the same way as they did with coke fires. They appeared to rely on a chimney draught to obtain the necessary heat from coke firing, and did very much the same with gas, and the result was inevitably high gas bills. That was corrected to an extent by putting in stabilisers in the flues and reducing the pull.

Mr. Manasseh agreed that some bakers were complaining about gas costs, but bakery engineers could not give an answer as to how to keep them down until they knew the circumstances under which these bakers operated their ovens. He himself impressed upon bakers that for economical running they should keep ovens fully occupied. What was even more important to be borne in mind was that there had been conversions of ovens which were quite unsuitable for the purpose, and in consequence there had been quite a lot of trouble with these ovens. With a reasonably modern oven, however, there was no snag to prevent it being quite economical if after conversion the operators used their discretion. Many bakers in Birmingham and district had their ovens converted to gas firing, and they were extremely pleased with the results. True, it cost them rather more than the price of coke; but there were several other considerations which counterbalanced this difference—no dirt, ashes, furnace repairs, and so on, not to mention labour problems, in which bakers were particularly interested under present conditions owing to the shortage of labour and rising wage costs. He thought the smaller unit, taking the proportion in relation to output, would always use more fuel compared with the large unit. To give an accurate comparison of costs they would need to know how many hours per day the oven was in use and the amount and kind of goods put through, and so on; for if an oven was left idle for a number of hours the consumption of gas would rise for the next stage compared with the average of an oven which was worked continuously. For example, a baker doing six sacks or even 12 sacks of flour per hour on a 24-hour day, was bound to have an extremely low fuel consumption compared with his output. He added that his firm had always favoured the use of stabilisers, and no trouble had been experienced in this direction.

Mr. H. R. Hems (Industrial Heat Treatment Department, Birmingham) said that the author had dealt with the subject admirably, giving them a general outline of what went on in a bakery and showing the various developments introduced by his firm through the years both in ovens and ancillary plant. It was obvious that the baking industry, in common with many other industries, had been going through the process of moving away from solid fuel. In all that they had heard, the one thing that stood out was that with all the developments which had taken place gas was the acknowledged fuel for certain particular jobs. Some experiments had been made with liquid fuels, but the general trend was towards use of gas. The chief concern at present so far as the gas industry was concerned, especially in the West Midlands, was the difficulty in meeting all the demands placed upon it, but he looked forward to the day, which he hoped would not be far distant, when they would be able to provide adequate supplies to satisfy all consumers and prospective consumers, including people with bakery plants. Conversions were all very well for certain types of ovens, but if bakers desired to use gas correctly, then they ought to use it in a correctly designed oven.

Mr. F. A. Reynolds remarked that a previous speaker had mentioned the old baker who relied on pull through, and stabilisers had to be put in to prevent this. Could the author give a little more detail about these stabilisers; how they worked and whether they were devised to work in ovens converted to gas firing. Having fitted in stabilisers, did he take it that it was not necessary to put a break in the flue.

Mr. Manasseh replied that in the last batch of ovens they had built in Birmingham they had put in Imo stabilisers—a weighty addition and the first of their type he had seen. Shorn bafflers had generally been used, but some bakers were now fitting Imo stabilisers. In all gas-fired ovens they now included some form of stabiliser, and there was no break in the flue.

Mr. S. Brockbank asked what sort of load they could expect if bakers generally were to use gas ovens, and when the peak loads would be likely to occur. The baking industry seemed to be in a somewhat similar position to the gas industry, being called upon to 'deliver the goods' as and when required.

A Continuous Load

Mr. Manasseh replied that in the case of plant bakeries the load was fairly continuous, the actual peak was, of course, when the oven was first lighted. Two plant bakers in the Stoke-on-Trent district, which Mr. Brockbank knew, lit up their ovens on Saturday night and did not stop them until next Saturday mid-day. It was when they were lighting up an oven which had been allowed to cool that they burned the maximum amount of gas. The travelling oven on full production used about two-thirds of the maximum. A six-sack oven used approximately 3,000 cu.ft. per hour, and it was rather a different matter with the average small family baker, who would start baking in a couple of hours after his dough was prepared. If he used a gas fired oven, he would only need to fire it for an hour before starting to bake, and would go on baking through the night. He supposed the baker would finish up his bread at four or five o'clock the following morning, and would then start on his tea cakes, fermented buns, and scones, which goods did not require so much heat as bread. By breakfast time the baker was just about at the fancy bread stage, and in the normal way he then started on confectionery. In the old days a baker with a solid fuel fired oven could go on baking right through the morning, and graded his baking accordingly. He would start with his big stuff which required a temperature of 500°, and very often a small baker could go on right through the day on a gradually falling temperature, until in the afternoon he would up with his oven temperature somewhere round 300° to 350°. It might be that he wanted between while to bake something that required more heat, so he promptly flashed the oven up and gave it an hour on a high figure. Hence the difficulty in estimating loads and costs.

Mr. R. Kimble referred to gas ovens of the portable type installed in Birmingham, and said in one case the flue was arranged for though never connected, but the building happened to be 30 ft. to 40 ft. high. He wondered whether the fact that these ovens had been left without flues had in any way a detrimental effect on the functioning of the oven.

Mr. Manasseh said he had seen these ovens, and as the building was so lofty he did not think that harm would arise without flues, though how the oven performance was affected he did not know.

The Appearance of INDUSTRIAL GAS EQUIPMENT

By F. C. FORDER, M.M., Assoc.M.Inst.Gas E.,
North Thames Gas Board

This paper to the London and Southern Junior Gas Association, on March 9, stresses the necessity for continued improvements in the appearance of industrial gas equipment to keep pace with similar changes in design of industrial plant in general. The requirement of modern design is outlined and its application to gas appliances, controls and fittings indicated, together with several suggestions.

THE changing appearance of industrial plant can be followed through many phases. The earliest designs were rude and simple, being the mechanisation of an elementary process or operation with the limited materials then available. Later, with the use of iron castings, a period of extreme ornamentation ensued, examples of which are still preserved for us today in some of those early gas appliances or station meters housed in their miniature Parthenons with columns and pediments. The two world wars each demanded material economy which, coupled with advances in mechanical development and uses of new materials, produced simple and functional designs. Our present design principles may be claimed as having their roots in those years between the war when the much abused word 'streamlining' was fashionable.

The adoption and development of the present ideas on design have been further accelerated by this country's present necessity to boost its exports. Exporting manufacturers have found that their products must have pleasing design in addition to possessing a high efficiency of operation and standard of workmanship.

Although there are manufacturers of industrial gas equipment who are fully aware of these desirable features and who are doing noble work, there are many who are lagging behind. It is a strange fact that if today we study advertisements in the technical Press we will, in the majority of instances, see equipment the appearance of which has clearly been the subject of some thought; yet we all know of equipment being installed today by those who mentally dwell in those years of our fathers or our youth and who acknowledge their deficiencies by refraining from pictorial advertising.

The advantages of good appearance lie not only with the sales appeal in the catalogue or showroom but in the increased efficiency of the operatives. The resultant rise in production due to the effect of suitable colouring of machine parts and surroundings[1] is an example. The benefits of the redesigning of machine parts, accompanied by improvement in their appearance, have also been frequently acclaimed.

Although the examples given so far are applicable to industry generally, they should act as a spur to designers of industrial gas equipment.

Design Principles

The accepted principles of design today are broad and cannot be defined easily. They will, of course, vary with personal taste and are controlled largely by the local circumstances and operational and process requirements. Generally the aim is to give a smooth, plain sided, well balanced, and proportioned appearance with extraneous fittings and projections avoided or brought together under a cover in complete harmony with the rest of the equipment. The colour and nature of the finished surfaces are also considered.

The problem to the designers of gas-fired industrial appliances and their ancillary controls and fittings can be regarded as coming within four principal headings:—

1. The case.
2. The stand or supports.
3. The fittings, controls, and ancillary equipment.
4. The flue.

It will be appreciated that, although each group in itself contributes much to the appearance of the equipment, its full merits are best assessed when considered together with the others in the final picture. To obtain more detail, each group will be covered more fully. For obvious reasons it will be appreciated that proprietary designs, in particular the inferior ones, cannot be illustrated in this paper.

The case is perhaps the most important part, to which the greatest attention should be paid, for, having the major surface area, it is this that gives the first impression of the appearance of an appliance. First impressions are sometimes difficult to lose and, therefore, the principal task is to create a pleasing and attractive outward appearance.

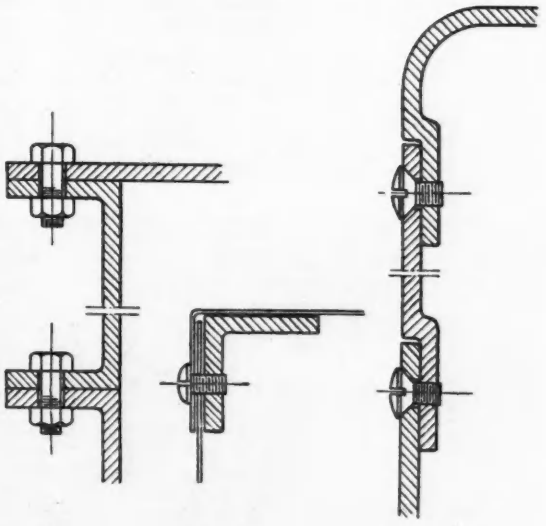

Fig. 1 *Fig. 3* *Fig. 2*

The shape of the outer casing will naturally be indirectly influenced by the shape of the working space or combustion chamber within the appliance. Most often a rectangular or circular external shape is, therefore, adopted and these require smooth, clean surfaces. Rounded corners offer a pleasing combination with the well proportioned surfaces.

The continued use of heavy, rough-surfaced castings jointed usually at the corners and at intermediary positions along the sides with large bolted flanges still persists with some appliances today. Castings are necessary in some designs, but much could be done to improve their appearance. The rough surfaces that are sometimes encountered due to air holes, mould surface blemishes, etc., and not to the coarse sand texture, can usually be remedied by the foundryman. Lighter castings could be of aluminium, which will enable a much smoother finished surface to be obtained.

Elimination of these conventional flanges, Fig. 1, could

be achieved by the use of lapped joints as shown in Fig. 2 where, although the corner has been rounded, the outer surfaces maintain a smooth line. The lap joints are not so obvious to casual inspection and the use of mushroom or raised headed screws tapped into the inside castings avoids those large projecting hexagon headed bolts. The extra cost, if any, in furnaces for instance, from shaping the bricks which line the inner surfaces should be small for they are invariably of the soft insulating type which is easily worked; with appliances made in some numbers they may be moulded.

It is the practice of certain manufacturers to display their name largely and completely on one of the front castings. One cannot blame them for this for they were, and apparently still are, proud of their product, but a smaller and more compact nameplate could be fitted with benefit.

It is common practice with some smaller appliances to make the frame of welded angle members and to panel with steel sheet. This produces an appliance of moderate appearance which is often marred by the use of large projecting hexagon bolt heads. Once again the use of mushroom or raised headed screws could be considered. Instances have been seen where the nut has been fitted on the outside, leaving a considerable portion of unused thread projecting to ensnare the unwary. One case was a circular pot type furnace and one was caused to wonder how the top angle ring could be removed for any subsequent maintenance.

The panels are usually fitted to the inside of the angle members and it may be claimed that extra strength to the structure is so obtained. This condition could also be achieved without any extra cost and, in addition, an improvement in the appearance be made by fitting the sheet on the outer surfaces of the angles as shown in Fig. 3.

The folded and lapped covers should prevent buckling of the edges and, at the same time, give a smoother finish. Horizontal gaps between the angle and the sheet which usually develop with buckling and become filled with dust and dirt should be eliminated. This method simplifies access to the centre of the appliance when repair or rebricking is necessary.

Fig. 4

The finish of the outer surfaces is as important as the external design. Sprayed paintwork gives a more even texture than brushed and should be considered wherever possible. Polished aluminium surfaces usually only retain their brilliance for a short period and an anodised coating, although having a slightly duller initial appearance, retains a lustre even under severe working conditions. There are, however, two points to be noted if this finish is to be applied; firstly, wax impregnation of the oxide layer to seal the pores must not be applied to surfaces that are liable to become warm,

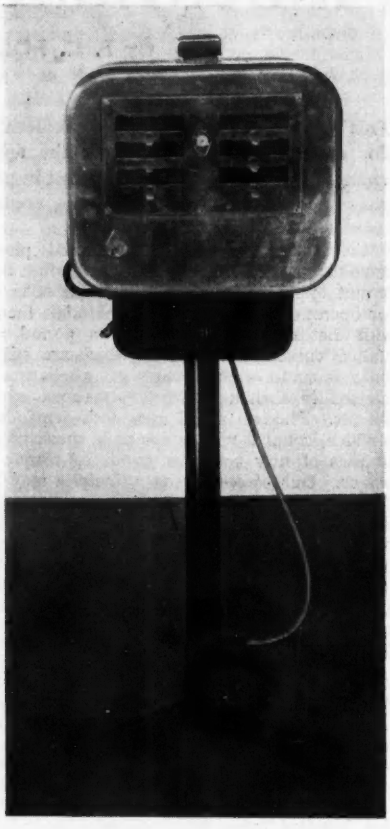

Fig. 5

and, secondly, the correct casting alloy must be used. The polishing charges for aluminium castings can be reduced by substituting a scratch brushed finish. This gives a cheaper and a more durable and uniform matt finish which can also be anodised.

The Stand or Supports

If a stand is necessary it should maintain the same clean and simple lines as the body and be in harmonious proportion to it. A large light body perched on a spindly column or legs can look top heavy although the supporting members are of sufficient strength. Cross bracing should be kept to a minimum or avoided and, where possible, one single central column is preferable to four closely grouped legs. Examples of single column support are shown in Fig. 4, the G.L.C. sugar boiler, and in Fig. 5, the experimental moulding powder preheating oven.

The practice of extending the legs up the outside of the casing to the top provides unnecessary projections, usually mars an otherwise smooth finish, and should, therefore, be avoided. Larger and heavier furnaces have been supported on several horizontal H section steel members which, in addition to being a waste or misuse of steel, also provide excellent dirt traps to increase, with time, the generally poor appearance of such construction. These members are surely not necessary in supporting the weight of the furnace, and if conditions require that the hearth be raised slightly, then

a brick plinth would do equally as well and improve its appearance. If ventilation is essential to the furnace base then an alternative design or elimination of the need for such ventilation should be sought.

Ancillary Equipment

Fittings, controls, and ancillary equipment are probably the concern of us all and, although they carry the lifeblood of our industry, they seems to be the most neglected when the task of redesigning equipment occurs. There appears to be a certain apathy in our demands, since we accept unsightly pipes and fittings as inevitable. Very often an appliance with an outer casing of a high standard to which great thought and ingenuity has been applied is finally spoiled in appearance by its fittings. In the past the appliance designer was not entirely to blame, for he has been restricted to the use of

Fig. 6

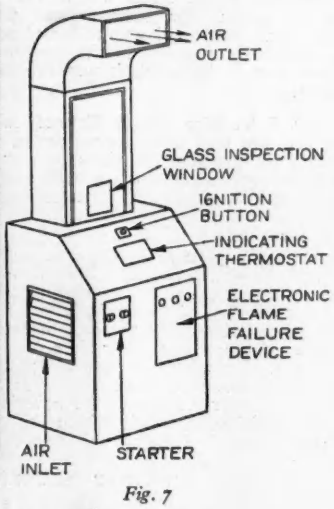

Fig. 7

available controls and fittings from other manufacturers, it not being economical to produce his own. Recently, and not before time, some of these controls have undergone a refining process which has resulted in a more attractive appearance.

The adoption of curved or domed tops has avoided the sharp corners and dirt traps, and the smoother lines of their bodies and the use of more suitable materials and methods of casting are all giving us something which we should be pleased to display. Paradoxically, with this development it is felt, for aesthetic reasons, that wherever possible all supplies, fittings and controls should not be left clinging to the appliance but be incorporated within the outer case. A well proportioned box or panel to house them could be designed without incurring great additional cost.

Air heaters are one typical example of the use of a number of necessary controls and fittings. Fig. 6 illustrates such an installation and should be compared with a new design of heater, still under construction, shown in Fig. 7, where all fittings and the fan are enclosed in the bottom casing. This heater will possess similar controls to those shown in Fig. 6 except that the thermo-electric flame failure device will be replaced by an electronic device with spark ignition. These are, however, of minor consideration in this design problem.

An example of utilising the gas supply as part of the design is illustrated in Fig. 5 where the central supporting column is used to convey the gas from the bottom inlet to the controls housed in the lower part of the body.

Where supplies are unavoidably exposed it should be unnecessary to-day to insist on their being absolutely horizontal or vertical, for a few degrees either way can spoil an otherwise good installation. The ugliness introduced by the use of flanged joints and large ungainly supporting pipe clips or brackets must also be considered. Larger supplies can be made with fittings designed for butt welding, which makes possible pipe runs of one uniform thickness.[2]

In instances where the fittings are integral with the appliance, a greatly improved appearance can be obtained with the elimination of screwed threads and fittings as much as possible. It is the unused portions of the male threads and the necessarily thick fittings, such as elbows, sockets, etc., that do much to make a screwed supply so damaging to the appearance of an appliance. It is accepted that such supplies must, for reasons of strength, availability, and cost, be made of mild steel tubing, but the use of fittings can, in many cases, be reduced by the use of tubing bent to the desired shape. A saving in the overall cost of material can be achieved, as is indicated in the following table, where the price of a one foot length of tubing is taken as one unit and the price of other fittings as multiples of that unit.

	1 in. B.S.P.	2 in. B.S.P.
1 ft. tubing	1.0	1.0
90° bend	1.7	2.3
90° elbow	1.1	1.3
Short	1.3	1.2
Stub nipple	0.8	0.8

If, for example, a double set one foot in total length is made in a 1 in. B.S.P. supply using two elbows, two shorts and a stub nipple, the cost of the fittings would be 5.6 units, but, by setting a piece of tubing, the material cost would be only about one-sixth. The slight extra labour costs that may arise could be offset by the reduced storage space and handling charges.

Flues

It is not intended to comment much on these necessary fittings or to discuss the merits of the various types available They must be accepted. We cannot do without them, but they should be kept as much as possible in the background or to the rear of the appliance and the same care of alignment as was stressed for the gas supplies is equally as important.

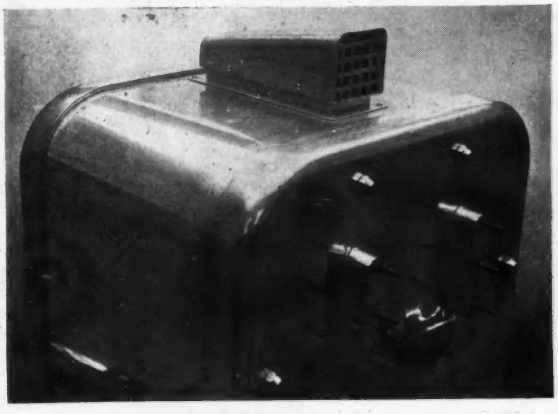

Fig. 8

With appliances consuming only a small quantity of gas and which do not require venting, the flue opening is sometimes unfortunately left as a slotted duct projecting from the top of the appliance. This could, with advantage, be concealed by a cover as illustrated in Fig. 8, which shows the flue cover box of the experimental moulding powder preheating oven.

Each desirable feature has been explored, not fully in the time available, but sufficiently to enable some appreciation of the problem to present itself. The ascetic approach to design can only be made with full consciousness of the fact that appearance and the accessibility of burners and controls for maintenance must go hand in hand. In these days of

price competition and rising costs, much can be done without increasing charges, as has already been shown with respect to the restricted use of gas fittings. Uniformity and standardisation of design need not be feared, for variations to suit or blend with the installation's environment can always be made, as is shown with the cremator in Fig. 9.

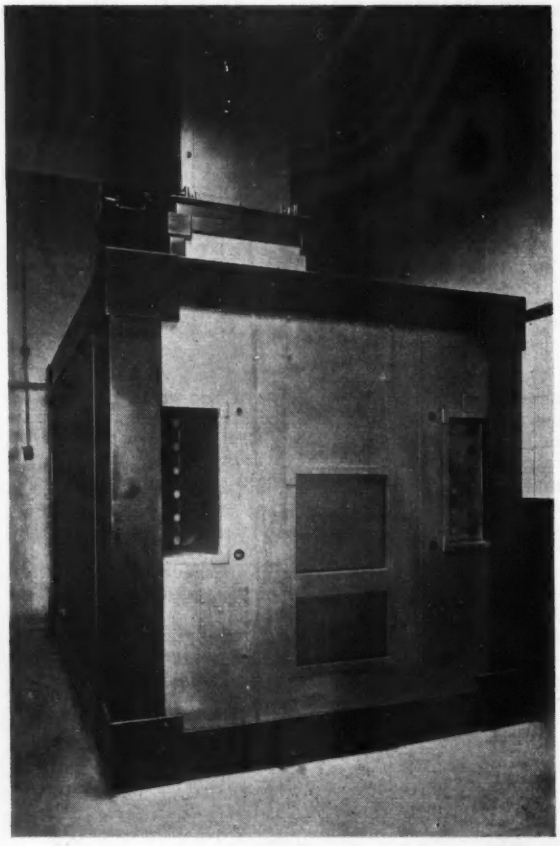

Fig. 9

Since so much industrial gas equipment is made singly and mass production is not often possible, carefully considered design must be an attitude of mind to be cultivated by the designer and draughtsman so that the broad principles discussed above will become second nature. With the periodic review of existing equipment we should be able to produce designs bringing the industry credit and which will receive the warm approval of Josiah Pemberton, the pioneer of industrial gas[3], should he look upon the offspring of his early efforts.

References

[1] *The Times* Review of Industry, June 1949, 13.

[2] 'Butt Welded Fittings for Pipe Lines,' *The Engineer*, 190 (4932) 131, 4th Aug., 1950.

[3] 'The Rise of the Gas Industry in Britain,' Dean Chandler and A. Douglas Lacey, British Gas Council 1949, 58.

DISCUSSION

The President (Mr. T. V. Garrud, North Thames) said that running through Mr. Forder's paper was recognition of the wonderful work of the late Mr. Dieterichs in connection with this problem and with the enormous strides which had been made in the design of industrial gas appliances. The paper was, indeed, a tribute to him and a lasting memorial to the grand job he did.

Mr. A. E. Livett (North Thames) agreed that recent changes in industrial design were to a very great extent consequential upon the work of Mr. Dieterichs. He had particularly in mind the case of an oven builder who used to make bakers' ovens with sharp corners and bits and pieces all over the place, which never looked very atractive. Today there was an oven by the same manufacturer on the Hovis stand at the Ideal Home Exhibition which was a really beautiful job. The finish was wonderful; the corners were rounded; the controls were out of sight; and there was a wide door fitted with finger control counter balances. The whole piece of apparatus was a fine advertisement to the gas industry—so much so that people thought it was an electrical oven! Arrangements had since been made to display a notice alongside the oven to say it was gas. It was a fact that design had so far advanced that there was a tendency for the public not to recognise equipment as gas.

Mr. J. R. Johnson (South Eastern) referred to the heavy expense which manufacturers might have to face in altering their castings to meet improvements in design. The best example of what could be done while still keeping expenditure within reasonable limits was in the gas cremator illustrated in the paper. Mr. Johnson was not convinced that they wanted all their appliances to look like cabinets. They should be primarily concerned with performance, and there were circumstances in which it was far easier to employ straight edges.

Mr. J. V. Rigg (North Thames) said that Mr. Forder had covered the field of industrial design very adequately, but he would like to give his views on a point in connection with domestic appliances. There were cases where styling was not as good as it might be. The tendency to make an appliance look 'expensive' was not always conducive to easy cleaning.

Mr. Thompson said that as a representative of a furnace manufacturer he regarded the question of appearance as an important one, and his own company had always recognised the desirability of such principles. He was interested in Mr. Johnson's point about the cost of enhancing appearance. To make a furnace look better did not necessarily entail additional expense. Sometimes it actually reduced the cost, while at the same time strengthening the furnace structure. With large furnaces streamlining and the covering in of the fittings was most useful, particularly where the operators had to handle heavy charges. They should have done this many years ago.

Consumer Not Interested

Mr. E. A. K. Patrick (North Thames) observed that when one propounded Mr. Forder's arguments to the consumer one often found he was not particularly interested in appearance. He was much more interested in efficiency and economy. The people they were trying to interest were not the immediate users of the apparatus but those who saw the apparatus when visiting the users' works. They would then react—even if only sub-consciously—to appearance. The consumer was not prepared to pay more for improved appearance, and Mr. Thompson had answered that point when he said there need not be additional cost for improved appearance. If one started from the beginning there was no reason why it should cost any more. The whole thing resolved itself into an attitude of mind, as Mr. Forder had said.

Mr. N. R. Junkisson (North Thames) said that if an appliance was designed to do its job properly the question of appearance almost came naturally. There would always be a market for appliances designed for the simpler jobs where appearance counted for very little indeed. There was no doubt that they had lagged behind in design, and for that reason they now found people thinking that a well-designed gas appliance was electrical. In the case of really big industrial equipment built on the site as a single installation which would not be repeated it was more difficult to embody the suggestions contained in Mr. Forder's paper, and in such instances they would continue to leave the fittings uncovered-in. The design of small gas-fired steam boilers offered a very good field for tidying-up because they were usually fitted in positions where appearance counted for a great deal. Too much casing-in was apt to make it difficult to get at the parts for maintenance and replacement. They did not want to have to dismantle an installation in order to get at a particular part. He enquired whether Mr. Forder could say how much of the cost of the cremator went into its appearance and how much into its efficiency.

Mr. F. S. Eames (North Thames) said that fish-fryers were very difficult to adjust; the fitter had to climb through the back and lie in the grease to make an adjustment. There

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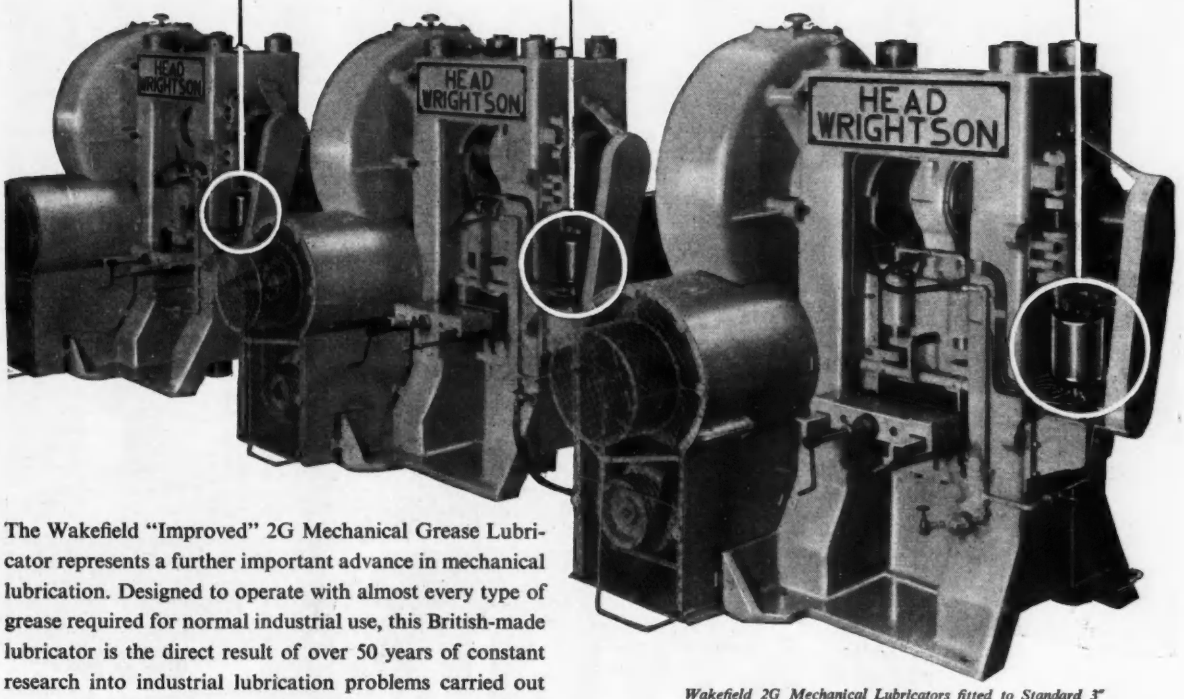

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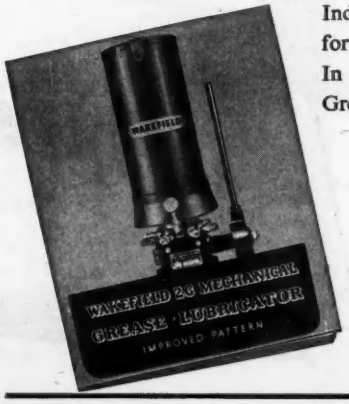

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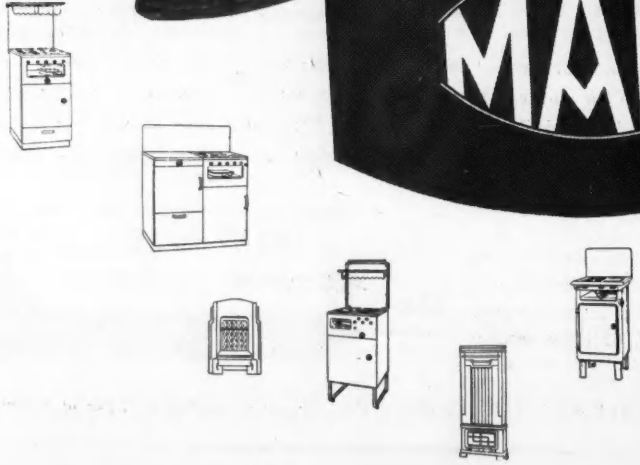

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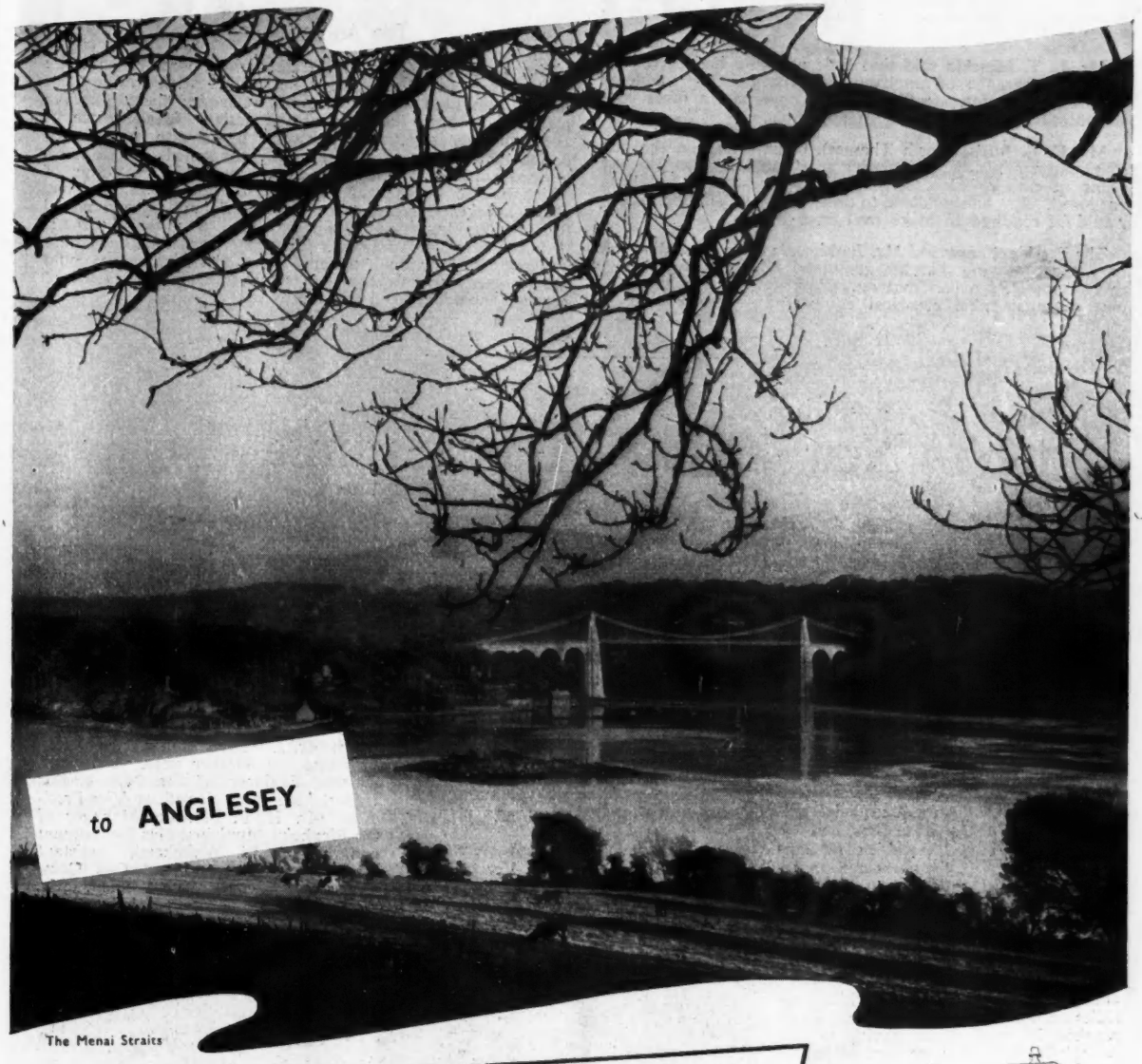

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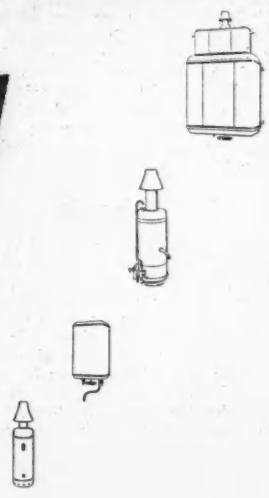

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was need here for improvement in design. The great majority of domestic gas cookers were fairly readily maintained, but he foresaw that when it was necessary to change the panels by a major operation revealing the interior to the consumer the latter would be shocked at what was disclosed. Improved design would necessitate the issue of new sets of tools to fitters.

Mr. L. T. Minchin said that little attention had been paid to the appearance of appliance governors. He wondered whether it was not possible to make governors a more convenient shape for building into apparatus.

Mr. F. E. Mills (North Thames), commenting on the last speaker's remarks, said that governors could be put into any shape of casing; indeed, one of hexagonal design had been produced. But he shuddered to think of the calculations which would be required to make oval ones.

The President answered Mr. Junkisson's query regarding the cremator by saying that the additional cost was about twice that of standard makes, but only about one-half to one-third that of comparable electrical equipment. He was glad to note that Mr. Forder referred to this apparatus as a 'cremator.' Nomenclature was very important—and they must try to get out of the habit of referring to 'gas-fired' appliances or, carried to its ultimate conclusion, they would be speaking of 'gas-fired cookers' and even 'gas-fired fires.'

The Author's Reply

Mr. Forder, replying to the discussion, observed that the word 'streamlined' should not be applied to this subject. It was a term used in aerodynamics. Changes could not take place all at once, but only as the design of each piece of apparatus was periodically reviewed. It was with simplicity of design that they were now primarily concerned. 'Style' was a word normally applied only to luxury goods, the design of which had to be changed regularly to promote sales. They could not keep changing the 'style' of appliances designed for functional purposes. While they liked to see round corners, they could not be applied to furnaces where limitations were imposed by functional design. Ease of maintenance could not be over-emphasised, and a compromise must be achieved between appearance and accessibility.

New Zealand Gas Institute

Conference at Wanganui

THE 1951 Conference was held in Wanganui on February 6, 7 and 8 under the Presidency of Mr. J. W. Atkinson, Engineer and Manager of the Wanganui Municipal Gas Department.

The proceedings opened with a civic welcome by the Mayor of Wanganui, the Hon. W. J. Rogers, M.L.C., on behalf of the City Council. After the official welcome, Mr. J. W. Atkinson presented his presidential address in which he surveyed the history of the Wanganui undertaking and drew attention to the fact that his predecessor, Mr. Stone, was the instigator of the foundation of the New Zealand Gas Institute. A general debate ensued relative to the position of the gas industry in light of the recent economic changes in New Zealand, in which subsidies on coal had been abrogated, which resulted in most works having to pay over 100% more for the coal as landed on the gasworks. The effect of these heavy increases were considered in the light of the powerful hydro-electricity competition, particular emphasis being placed on the fact that electricity is manufactured by a department of the Government and is retailed through tax-free local bodies.

Gas Purification

In the afternoon session, Mr. J. S. Hungerford, B.SC., the Assistant Chemist of the Wellington Gas Company, gave a paper outlining his research into the optimum conditions under which Onekaka and Okaihau oxides of iron can be used for the purification of coal gas. This paper was of particular interest as members have recently been studying the British Gas Research Board's work on the migration of sulphur theory.

On Wednesday morning, Mr. E. F. Gorman, Engineer of the Christchurch Gas Company, gave a paper 'Observations Abroad.' This dealt mainly with Mr. Gorman's observations of the gas industry in America, and commented on several salient points of the industry in Britain, Germany, and France. During the afternoon members visited the Wanganui gasworks and were able to view the operation of the new Humphreys & Glasgow carburetted water gas plant.

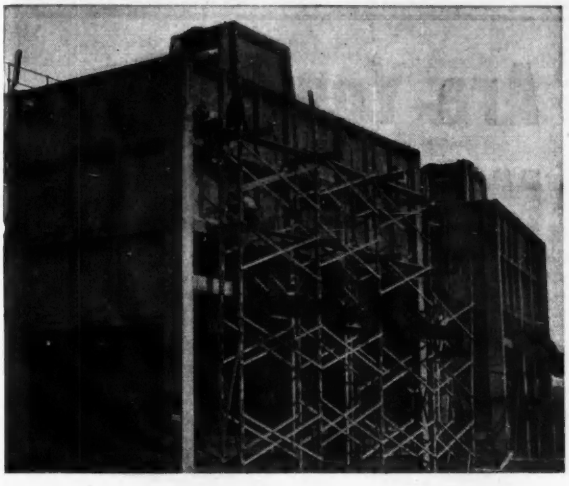
On Thursday two papers were presented—the first by Mr. A. Veart, Distribution Engineer of the Auckland Gas Company, entitled 'Some Thoughts on Post-war Distribution Problems.'

The afternoon session was taken up with the paper presented by Mr. Raymond, Works Manager of Invercargill, entitled 'Coal Handling on a Small Gasworks.

Following this paper the Institute held its 27th Annual General Meeting, at which Mr. J. W. Atkinson was re-elected President for another year. Mr. C. I. Kidson, Engineer of the Nelson Gas Undertaking, was elected as Vice-President; Mr. H. E. Bungate, Manager of the Blenheim Municipal Gas Department and Mr. C. W. Whitehead, Assistant Engineer of the Auckland Gas Company, were elected to the Council. Mr. E. F. Gorman was re-elected Secretary-Treasurer for the ensuing year.

A group of members at the Wanganui Conference.

Gunite



One of the reinforced concrete structures reconditioned with Gunite for the City of Carlisle Gas Undertaking.

Gunite—concrete applied by air pressure has numerous applications where its great density and extreme adhesion have exceptional value.

For repairing reinforced concrete it has particular merit, as, due to the method of application, a uniform density and adherence is obtained whenever Gunite is applied.

For lining coal bunkers and steel chimneys it possesses great resistance to corrosion and protects steel-work from the abrasive action of coal or coke

Handbook "GUNITE" sent on request.

THE CONCRETE PROOFING CO., LTD.

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100 years ago

Emigration 1850

EMIGRATION.—Vessels which are to leave the London Docks for Australia, New Zealand, and Port Natal shortly are expected to carry 1200 emigrants to these countries. With regard to the women wishing to emigrate overseas, the report of the Female Emigration Fund Committee states that more needlewomen are not particularly wanted because they would be unsuited to the colonies, and are, generally speaking, making fair wages here. The sloppworkers, and those engaged in coarse work, will not be taken unless they can cook or wash or act as domestic servants in some capacity.

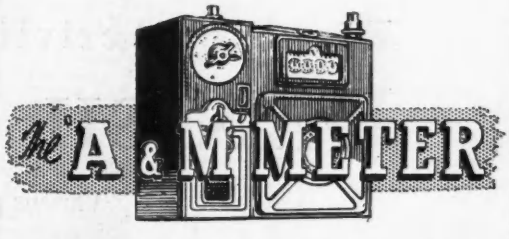
THE CESAREWITCH STAKES.—An intimation has been received from the Russian Consul-General that the annual donation of his Imperial Highness the Grand Duke Cesarewitch will henceforth be discontinued. It is the intention of the stewards to recommend [illegible] that the Cesarewitch

IT would appear that at all times the colonies have been more or less particular concerning the capabilities of intending immigrants.

Excerpt from "THE SCOTSMAN" 1850

Whilst we cannot subscribe to the oft repeated theory that the best technicians of our Country have sought their fortunes overseas, we cannot deny our pride and admiration for the foresight and pioneering instincts of our forebears whose technical skill and business acumen opened up and developed the overseas markets.

We salute that width of vision and abundance of energy which in the past 100 years has made the "A. & M." Meter available to many lands.



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Telephone: TIPTON 1958. STAFFS.

COMPRESSORS & EXHAUSTERS FOR AIR AND GAS.

See our Advertisement Next Week.

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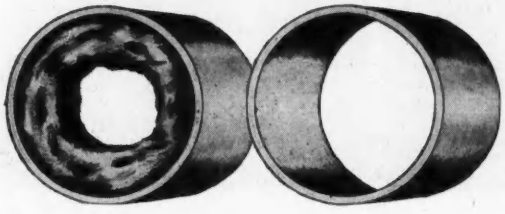

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PUBLISHERS' NOTICE

The "Gas Journal" is published every Wednesday, price 1/-; by post 1/2d.

NEW SUBSCRIPTION and CLASSIFIED ADVERTISEMENT RATES OPERATING FROM JAN. 1, 1951.

Subscription Rates: Home and Empire :- 52/- per annum; Foreign :- 60/- per annum. (Both payable in advance.) A copy of the "Gas Journal" Calendar & Directory is presented each year to continuous subscribers.

Classified Advertisements: All small classified advertisements are charged at 1/9 per line (approx. 7 words) - minimum charge 10/6. A Box Number address occupies 2 lines, and a further 6d. is charged towards cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's Journal.

Displayed Advertisements: Rates obtainable on application to the Business Manager. Change of copy for displayed spaces must be received 14 days prior to publication if proofs are required. Type area of inside pages 10" deep x 7" wide; block screen 120.

BUSINESS MANAGER: S. T. CULLEN

MIDLANDS OFFICE: 10, Union Street, Birmingham.

NORTHERN MANAGER: W. Q. Foster, 33, St. Helens Road, Harrogate. 'Phone: Harrogate 84291.

WALTER KING, LTD., 11, Bolt Court, Fleet Street, London, E.C.4.

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APPOINTMENTS VACANT

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FIRST Class FITTERS required. N.J.I.C. conditions and rates of pay.

Applications to be addressed to:—F. J. Edmonds, Engineer and Manager, Bromsgrove District, Worcs.

WEST MIDLANDS GAS BOARD

SHROPSHIRE DIVISION.

SENIOR ACCOUNTANCY ASSISTANT.

APPLICATIONS are invited from suitably qualified persons for the post of SENIOR ACCOUNTANCY ASSISTANT at the Divisional Headquarters of the Shropshire Division.

Applicants should have a good experience of accounting procedure, preferably with reference to the centralised control of accounts, and should be conversant with modern methods of machine accounting.

The salary for the post will be not less than £595 per annum on commencement, rising by annual increments to a maximum of £720 per annum, in accordance with Grade XI of the National Joint Council for Gas Staffs salary scales.

The appointment will be subject to such superannuation regulations as the Board may, in due course, adopt, and the successful candidate may be required to pass a medical examination.

Applications giving details of age, qualifications and experience, together with the names of two referees, should be addressed to Mr. C. M. D. Belton, Divisional Manager, West Midlands Gas Board, Shropshire Division, Sidney House, School Court, Shrewsbury, to reach him not later than fourteen days after the appearance of this advertisement. Applicants are requested to quote ref. T.P.3 when replying to this advertisement.

F. H. Cureton,
Secretary.

WEST MIDLANDS GAS BOARD

WALSALL AND DISTRICT DIVISION.

APPLICATIONS are invited for the post of WORKS CHEMIST to the South Staffordshire Mond Undertaking, Dudley Port, Tipton.

Candidates should be qualified and preferably have had experience of large gasworks practice, and a knowledge of modern boiler plant and feed water treatment will be an advantage. The person appointed will be responsible for the chemical control of the plant, and will have adequate assistance for routine work.

The salary for the post will be not less than £520 per annum on commencement, rising by annual increments to a maximum of £620 per annum in accordance with Grade IX of the salary scales of the National Joint Council for Gas Staffs.

The appointment will be subject to such superannuation regulations as may be made in due course, and the successful candidate may be required to undergo a medical examination.

Applications, stating age, qualifications and experience accompanied by the names of two referees, are to be sent to Mr. E. Hardiker, Divisional Manager, Walsall & District Division, Walsall Factory Estate, Tame Bridge, West Bromwich Road, Walsall, not later than fourteen days after the appearance of this advertisement. Applicants are requested to quote Ref. T.P.3 when replying to this advertisement.

F. H. Cureton,
Secretary.

ASSISTANTS required for Fuel Engineering Department of large modern steelworks in the Midlands. Applicants should be 22/25 years of age with good education, preferably up to National Certificate standard. Reply stating full details of education, experience and salary required to The General Manager (Iron & Steel Works), Stewarts and Lloyds, Limited, Corby, Northants.

EAST MIDLANDS GAS BOARD

NOTTS. & DERBY DIVISION.

DERBY UNDERTAKING.

INDUSTRIAL GAS ENGINEER

APPLICATIONS are invited from qualified Combustion Engineers for the appointment of INDUSTRIAL GAS ENGINEER in the Derby Undertaking. The salary offered for the post is in accordance with A.P.T. Grade XII of the National Salary Scales for the Gas Industry (range £645 to £770 per annum).

Candidates must have a sound theoretical and practical knowledge of combustion and utilization of heat for Industrial processes. Specialized knowledge of the use of gas in the warming of buildings and general engineering processes would be an advantage.

The successful applicant will be required to pass a medical examination, and the appointment will be subject to such superannuation scheme as may be adopted by the Board.

Applications stating age, qualification and experience, together with details of present and previous appointments and giving the names of two referees, should be addressed to the undersigned to reach him not later than 14 days after the publication of this advertisement.

K. L. Pearce,
Divisional General Manager.

5, Friar Gate,
Derby.

NORTH EASTERN GAS BOARD

HUDDERSFIELD/HALIFAX GROUP

HUDDERSFIELD DISTRICT.

APPOINTMENT OF SHIFT ENGINEERS.

(AMENDED ADVERTISEMENT)

APPLICATIONS are invited for the appointment of SHIFT ENGINEERS at the Leeds Road Works, Huddersfield, at a salary in accordance with Grade VIII, Provincial 'A', of the A.P.T. Scales for the Gas Industry, *i.e.*, £490-£570 per annum.

Applicants should have had a good all-round experience of gas manufacture and be capable of taking full charge of the Works out of normal hours. The gas making plant consists of Continuous Vertical and Horizontal Retorts, together with C.W.G.

The successful candidates will be required to pass a medical examination and to contribute to such Superannuation Scheme as the Board may adopt at some future date.

Applications giving details of age, experience and qualifications should be sent to J. G. Tilley, Group General Manager, North Eastern Gas Board, Huddersfield-Halifax Group, Leeds Road, Huddersfield, so as to arrive not later than April 12, 1951.

J. C. Gardner,
Secretary.

Bridge Street,
Leeds, 2.
March 20, 1951.

(*Classified advertisements continued on Supplement* 4)

APPOINTMENTS VACANT (ctd.)

SOUTHERN GAS BOARD

NORTHERN DIVISION.

BANBURY & DISTRICT GAS UNDERTAKING.

HOME SERVICE ADVISER.

APPLICATIONS are invited for the position of HOME SERVICE ADVISER to the Banbury & District Gas Undertaking.

Candidates should possess a recognised Diploma and have experience in the giving of cookery and other ancillary demonstrations, lecturing, running practical cookery classes and visiting consumers in their own homes to advise on the correct use of gas appliances.

The salary will be in accordance with the National Joint Council scales for Gas Staffs, within the range of A.P.T. Grade III. Provincial "B," and the commencing salary will be dependent on experience and qualifications.

Applications, stating age, qualifications and experience together with the names of two referees, should be addressed to the Engineer and General Manager, Banbury & District Gas Undertaking, Gas Works, Banbury not later than March 31, 1951.

WALES GAS BOARD

MANAGER—LLANGOLLEN UNDERTAKING.

APPLICATIONS are invited for the appointment of MANAGER of the Llangollen Undertaking of the Wales Gas Board, the Undertaking being under the general supervision of the Engineer and Manager of the Board's Rhos Undertaking.

Applicants will be required to give evidence that they have had sound experience in gas distribution and in the development of gas sales. Experience of gas production in hand-charged horizontal retorts is desirable, but not essential, as a bulk supply of gas will be made available to the Undertaking in the near future.

The commencing salary will be £450 per annum, plus free gas up to a maximum of 40,000 cu. ft. per annum. Living accommodation will be made available at a reasonable rental.

Applications, giving age, details of qualifications and experience and the names of two referees, should be submitted to the undersigned so as to be received not later than April 6, 1951.

C. B. MAWER,
Secretary.

1/2 Windsor Place,
Cardiff.

WALES GAS BOARD

AMMANFORD UNDERTAKING—MANAGER.

APPLICATIONS are invited for the appointment of ENGINEER AND MANAGER of the Ammanford Undertaking of the Board.

The present annual output of the Undertaking is 45 million cu. ft., and considerable scope for development exists. A bulk supply of gas will probably be made available to this undertaking in approximately two years.

Applicants will be required to have experience of gas manufacture in horizontal retorts, and should in particular have thorough experience of sales development, the improvement and extension of distribution systems, and of unaccounted for gas problems.

The commencing salary will be £575 per annum, plus fixed quantities of free coal and gas. A house will be made available at a reasonable rental.

Applications, giving details of age, qualifications and experience, together with the names of two referees, should be submitted to the undersigned so as to be received not later than April 6, 1951.

C. B. MAWER,
Secretary.

1/2 Windsor Place,
Cardiff.

SOUTH WESTERN GAS BOARD

ASSISTANT CHEMIST ON AREA SCIENTIFIC STAFF.

APPLICATIONS are invited from suitably qualified chemists for the above appointment at a salary within Grade A.P.T. VI of the National Salary Scales of the National Joint Council for Gas Staffs (£415 to £495 per annum).

The person appointed will be under the control of the Board's Area Scientist and will be based at Area Scientific Headquarters, Canon's Marsh Gasworks, Bristol. The duties of the post will include such general analytical work as may arise in the Department, with special emphasis upon the assay and ultimate analysis of coal, coke and gas-oil, together with the reactivity of coke and the behaviour of ash.

The possession of the Higher National Certificate in Chemistry is the minimum qualification.

Applications, stating age, qualifications and particulars of training and experience, together with the names and addresses of two persons to whom reference can be made, should be received by the undersigned not later than April 7, 1951.

W. N. CURTIS,
Secretary and Solicitor.

9a, Quiet Street,
Bath.
March 15, 1951.

NORTH WESTERN GAS BOARD

OLDHAM-ROCHDALE GROUP.

CHIEF CLERK.

APPLICATIONS are invited for the position of CHIEF CLERK at the Gas Offices, Dane Street, Rochdale.

Applicants should be qualified to take control of and supervise the office establishment. The person appointed will be responsible for all clerical routine and the preparation of such financial and statistical records as may be required.

The commencing salary for this position will be within the range of £450/530 per annum in accordance with Grade A.P.T. VII of the National Salary Scales.

The successful applicant may be required to pass a medical examination, and to subscribe to such scheme of Superannuation as the Board may adopt.

Applications endorsed "Chief Clerk" and giving personal details, particulars of training, qualifications and experience, together with the names and addresses of two referees, should reach the undersigned not later than twelve days after the publication of this advertisement.

CECIL H. BAMBER,
General Manager.

Gas Offices,
Dane Street,
Rochdale.

NORTH WESTERN GAS BOARD

OLDHAM-ROCHDALE GROUP.

STATION ENGINEERS.

APPLICATIONS are invited for the position of STATION ENGINEER at the Dane Street Gas Works, Rochdale, and the Hollinwood Gas Works, Oldham.

Applicants for the above positions should hold the Higher Grade Certificate of the Institution of Gas Engineers, or its equivalent, and should have had extensive experience in the control and operation of vertical retorts, carburetted water gas plant and gas works ancillary plant.

The salaries for these positions will be as follows :—

Rochdale Dane Street Works	£850 per annum.
Oldham Hollinwood Works	Within the range £595/720 per annum—Grade A.P.T. XI of the National Salary Scales for the Gas Industry. (A house will be available to the successful applicant).

Candidates wishing to apply for either or both of the above posts need only send in one application but should state clearly to which position or positions their application applies.

The successful applicants may be required to pass a medical examination and to subscribe to such scheme of Superannuation as the Board may adopt.

Applications, endorsed "Station Engineer," giving personal details, particulars of training, qualifications and experience, together with the names of two referees, should reach the undersigned not later than 10 days from the publication of this advertisement.

CECIL H. BAMBER,
General Manager.

Gas Offices,
Dane Street,
Rochdale.

EDUCATIONAL

THE INSTITUTION OF CHEMICAL ENGINEERS.

27TH ASSOCIATE MEMBERSHIP EXAMINATION.

APPLICATION forms (returnable June 1, 1951) and particulars of the 27th Associate Membership Examination may be obtained from the Hon. Registrar, Institution of Chemical Engineers, 56, Victoria Street, Westminster, London, S.W.1. NOTE.—Written and oral examinations will be held in September, 1951. Home Papers will be issued in January, 1952.

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BARDSLEYS-COLCHESTER LTD. for ALUMINIUM LADDERS, A.L.1 extends 12 ft. £8 11s. 6d., roped £9 11s. 6d.; A.L.4 extends 20 ft. £13 9s. 0d., roped £14 9s. 0d.; A.L.8 extends 30 ft. £19 12s. 0d., roped £20 12s. 0d.; A.L.11 extends 38 ft. £24 9s. 6d., roped £25 9s. 6d. BARDSLEYS-COLCHESTER LTD., 'Phone 3670. List free.

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THE Swansea Undertaking of the Wales Gas Board invite from appropriate Contractors tenders for the laying of 18 in. diameter GAS MAIN from Neath to Morriston.

Applications for Specifications/General Conditions and Form of Tender with appropriate drawings to be obtained from the undersigned not later than Monday, April 9, 1951.

ERNEST ABLETT, O.B.E.,
M.Inst.Gas.E., F.C.I.S.,
Engineer, Manager & Secretary.

Swansea Undertaking,
Oystermouth Road,
Swansea.

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'Phone : Northern 0989. 'Grams : Reckoners, B'ham.

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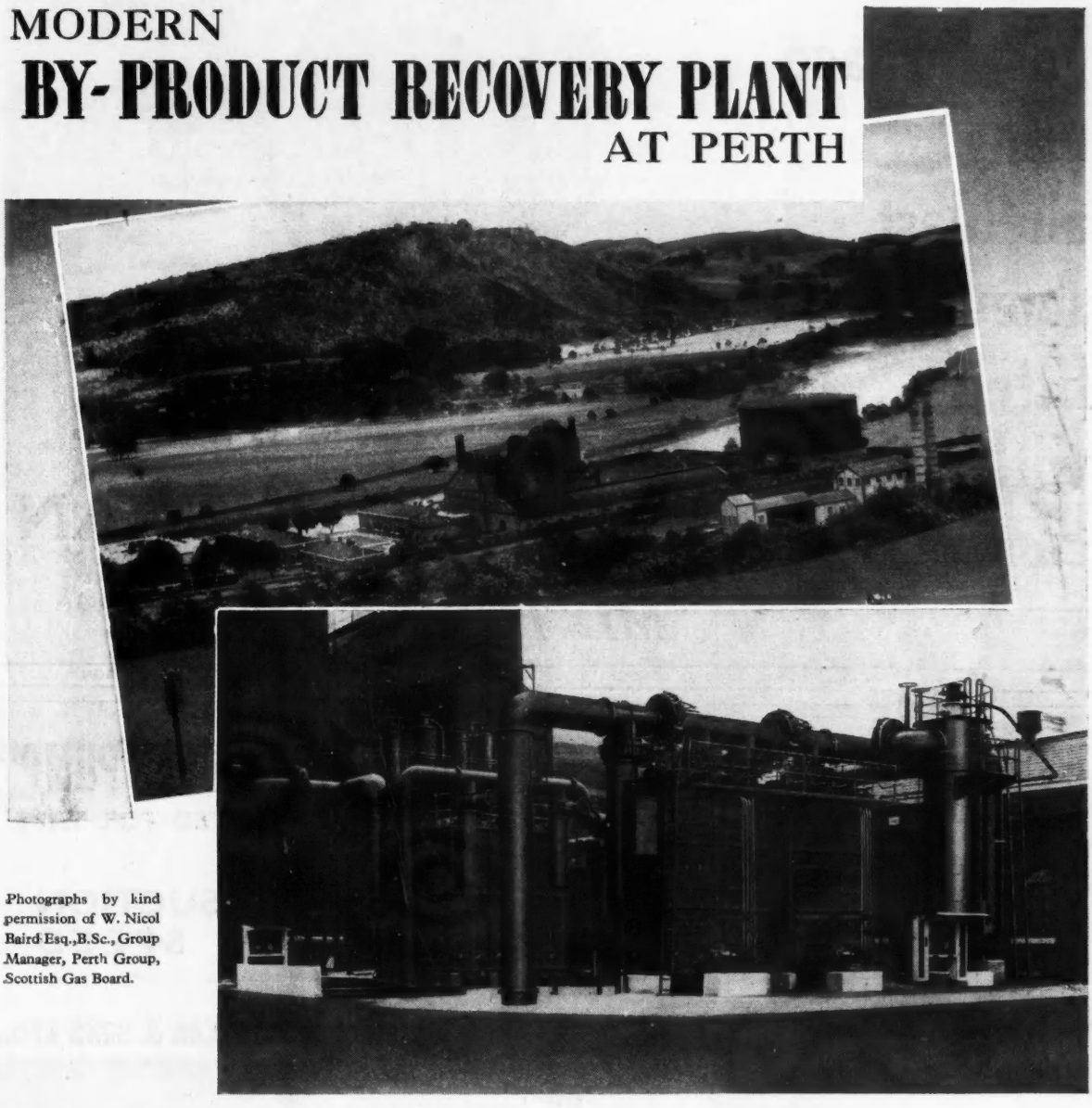

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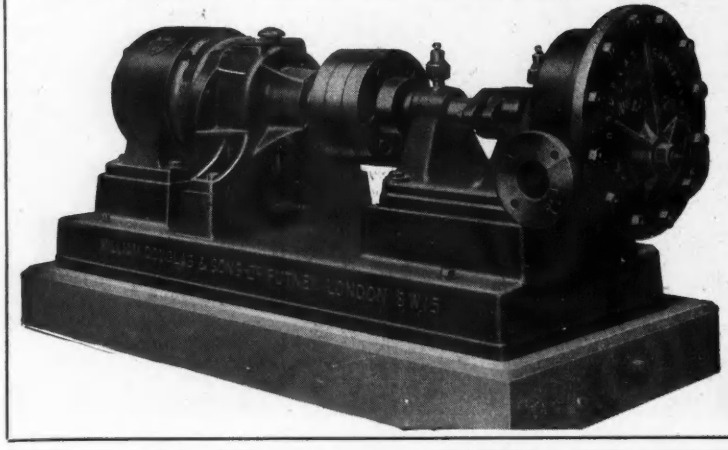

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COAL AND COKE SCREENING & SIZING PLANTS.

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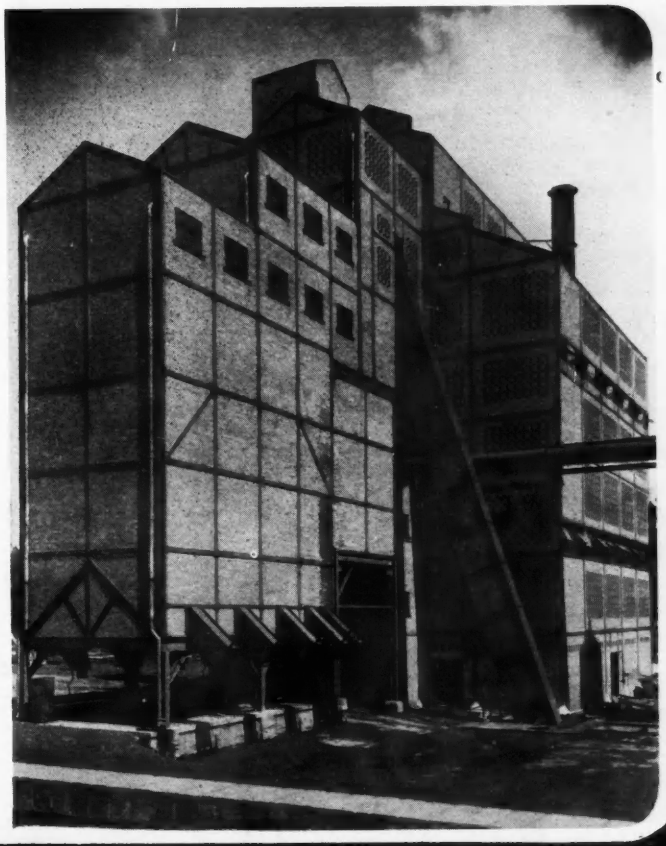
Printed by Straker Brothers Ltd., E.C.2, for Walter King, Limited, 11, Bolt Court, Fleet Street, London, E.C.4. Wednesday, March 28, 1951.

Work in progress



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A view of the Coke Plant end of the new Glover-West Retort House.

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Wellington's reply to Canning in 1827 when asked to become Prime Minister.

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FOR STEEL TUBES AND STEEL TUBE FABRICATION

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